KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. V. JANUARY, 1882. NO. 9.

GEOLOGY.

MARBLE OF SOUTHEAST MISSOURI.

BY PROF. G. C. BROADHEAD.

When connected with the Missouri Geological Survey I have, at various times during the past twenty-five years had my attention directed to the marble quarries in southeast Missouri.

The late Henry Cobb during his lifetime spent some time and money in striving to introduce these rocks as an ornamental stone. The result of his labor was the construction of a few mantles and table tops, chiefly used in the city of St. Louis. But thus far no capital has been invested in the work sufficient to make the business of commercial importance. My recent investigations in working up the Quarry Industry of the Tenth Census has again brought these rocks to my notice. The Cape Girardeau limestone has been termed a marble by some. It is a white, coarse-grained limestone burning into pure lime, also affording very large dimension stone. The State Capitol of the State of Louisiana, at Baton Rouge, was built of this rock and constructed probably thirty years ago. It was partially burned down during the late war, and at present blocks of the same stone are being sent South to repair the building.

A building in St. Louis, on Fourth street near Locust, used for a long time as a drug store had its front constructed of this stone. The smoke and weath-

ering of over twenty years have caused it at present to have quite a weather-beaten appearance and the frost has probably opened a few argillaceous seams in it. Otherwise it seems durable.

The quarry shows about twenty feet thickness of white limestone, one bed of which is six feet in thickness. The upper ten feet is a little brown tinged, and contains the characteristic fossil *Receptaculites Oweni*, showing the beds to be Lower Silurian of the age of the Galena group. The west end of the quarry presents an interesting feature in having an intrusion of brown sandstone thirty feet in width and widening northwardly, connected with overlying sandstone strata beyond. There really had been a ravine in the limestone prior to deposition of the sandstone, subsequently deposited and resting on and flanked by the limestone. The lime-quarries at Glencoe, St. Louis County, Missouri, are of the same geological age as the Cape Girardeau limestone and burn into excellent lime. At Glencoe a fine specimen of *Illenus* (*Bumastus*) *trentonensis* was obtained.

The marble quarries proper of southeast Missouri are included in two groups. The older or lower are Potsdam, the others are Upper Silurian. The Potsdam quarries are found in Madison, Iron, and Reynolds, and are located on Stout's Creek, and Marble Creek in Iron; Cedar Creek, Marble Creek and Leatherwood Creek in Madison, and Tom Luck Creek in Reynolds County.

CEDAR CREEK MARBLE.

Near Little Vine church, near the head of Cedar Creek, are several outcrops of variegated red and drab marbles. A section of rocks on a southeastern branch of Cedar Creek shows ten feet of coarse magnesian limestone resting on ten feet of light drab marble of fine grain, traversed with brown veins. A section on west side of St. Francois River near mouth of Leatherwood Creek shows

1. Four feet rough beds of dark ash magnesian limestone.
2. Four feet of gritty dolomites.
3. Four feet of fine-grained magnesian limestone spotted with green.
4. Five feet of whitish and brownish limestone.
5. Three feet of gritty dolomites.
6. Five feet of coarse, brown spotted magnesian limestone.
7. Two feet of fine-grained magnesian limestone, color drab.
8. Four feet magnesian limestone.
9. Twenty feet outcrops of marble, light color, with calcite specks and resembling that found on Marble Creek.

The rocks dip at an angle of 22°, course south, 65° west, near Little Vine church. The marble beds are red and alternate with red conglomerate beds which contain porphyry pebbles.

The finest exposure and containing the most handsome varieties of marble is on the land known as belonging to the Cooper heirs near the mouth of Cedar Creek, Madison county. I have recently heard that it was being purchased by the Knob Lick Granite Company, who probably would develop it. The marble probably underlies two hundred acres. The rock here has been quarried in small

quantities at long intervals, and is very handsome when polished. The colors blend beautifully. It really is thus far the best appearing marble in Missouri, both as to color, and arrangement of colors and texture. Its outcrop also shows it to be durable with no appearance of injury from frost after the wear of ages of exposure. Still, if used for outside work it would probably tarnish too much. For mantles and table tops it will probably compare with Tennessee or any other marble.

The oldest known outcrop shows a deep red rock with occasional small quartz crystals. The present excavation is small but shows beds from one foot to one and a half feet in thickness, said to be thicker below. The rock seems to be chiefly a pure limestone with many specks and lines of crystallized calcite, often a greenish shade around the cystalline facet blending off gradually into red, which often gradually deepens in color.

The quarry known as the "Rasnick" quarry is about four miles south of Ironton, on the head of Marble Creek, and the rock is here found for over a quarter of a mile apart or probably a half mile to distant outcrops. Most of the beds are rather shelly, but there are about two beds of good thickness, of uniform texture and handsome arrangement of colors.

Young's quarry on north side of Marble Creek, near east county line of Iron County, presents a face of twenty-five feet of rock extending for several hundred feet along the bluff. The texture is very fine and traversed by buff veins of coarser material. There are several other localities containing similar marble on the head branches of Marble Creek.

On Stout's Creek, four to six miles west of Ironton, are also outcrops of handsome marble. On head of Tom Luck Creek, in Reynolds County, are thick beds of flesh-colored marble.

At corner of Sections 5, 6, 7 and 8 of Township 32, Range 4, in Iron County, the beds appear thus:

1. Twenty-one feet of marble and conglomerate beds, including over twenty layers varying in thickness from a half inch to a foot.
2. Fifteen feet no rocks seen.
3. Twenty-two feet including beds of conglomerate, shales and marble, the latter shaded red, whitish and buff, but all in too thin beds to be valuable. Many layers being only a half inch thick, but the colors are all handsome and uniformly specked with calcite.

A general section of these marble beds as they occur in the northern part of Madison County is about as follows:

1. Magnesian limestone.
2. Eighteen feet of thick beds of silicious dolomite and thin shaly limestone with *Lingula lamborni.*
3. Twenty-three feet of gritty dolomite.
4. Five to thirty feet of marble.
5. Five to forty feet (as much as ninety feet near Mine La Motte) of sandstone.

6. A few feet of slaty sandstone resting on granite.

The presence of *Lingula lamborni* in beds a little above the marble will certainly assign the marble beds to the Potsdam group.

MARBLES OF NIAGARA GROUP.

Two miles north of Cape Girardeau, Missouri, on land of Dr. Thomas Holcombe, are outcrops of variegated purplish red limestone with occasional calcite specks. The bedding is thick and the marble would look well if polished.

Dr. Shumard in his geological report of Cape Girardeau County, Missouri, Geological Report 1855–71, makes favorable mention of this and other quarries. Dr. S. enumerates one hundred and forty feet of Niagara limestone one mile above Shephard's Landing, the lower eighty-two feet of alternations of purple, yellow, buff and gray with five feet of handsomely variegated limestone in the upper beds. Two miles north of Cape Girardeau his estimate gives

1. Twenty-six feet of laminated beds of brick red, sandy-textured limestone.

2. Thirty-two feet of fine-textured, red and purple limestone, clouded with yellow and green and containing *Calymene blumenbachii*, *Striatopora flexuosa*, and *Columnaria inequalis*.

3. Thick beds of bluish gray limestone with *Halysites Catenularia*.

He also speaks of the marble being found in Section 22, Township 32, Range 13. Similar beds occur in Perry County in east and northeast.

Dr. S. speaks of its occurrence at Janis' mill in St. Genevieve County, inclining at 80° to 90°, of fine texture and passing through various shades of flesh, yellow and green, pink, purple and chocolate, all handsomely blended.

Prof. Albert D. Hager now owns a small tract of land in St. Genevieve County, and is preparing to saw out slabs. Some specimens from this vicinity that I have seen show an exceeding beauty. I have seen also a specimen of dark chocolate color varied by darker wavy lines, all very handsome.

The chief drawback in working the marbles of southeast Missouri has been the beds generally are too thin to work economically.

SHELLS OF EUREKA SPRINGS, ARKANSAS.

BY F. A. SAMPSON.

During the fall of 1880 and the past summer, I made four visits to this now famous health resort of northwestern Arkansas, and during those visits I spent much of the time collecting the land and fresh-water shells of the vicinity. The shells of both classes are interesting, either from the rarity of the species, or from their variation and perfection.

The place takes its name from a large number of mineral springs found within a radius of a mile or less; though all containing more or less mineral, this is not apparent to the taste, and there does not seem to be anything in the water

distasteful to water mollusks, and these are found in large numbers in certain places.

While a considerable volume of water flows from part of the springs, yet by reason of the large amount of gravel in the beds of some of the streams, the water disappears in a short distance, so that in the dry season these beds show no water. This is true of West Leatherwood Creek especially, and in places where there are springs giving a large volume of water, and possibly, in part at least, the same water which disappeared higher up stream, again sinks out of sight within a few rods from these springs. In this stream I found shells of two genera only, *Physa* and *Ancylus*, the latter only above the highest point where the water sank into the gravel. In June I found *Ancylus tardus*, Say, quite large and but few in numbers; six weeks later none were found of more than about half size, but these were very abundant. At this same time those found in another stream were somewhat larger than at the former time, while they were much darker in color. In this latter stream the size was about the same as in the November preceding. In the first mentioned stream *Physa gyrina*, Say, were found in large numbers; at the highest point the shells were the finest, while further down, at Sycamore Springs, they were badly eroded. In one of the branches of this stream *Physa heterostrophe*, Say, of small size was found in June with very clear and clean shells while six weeks after they were of the same size but almost black.

Leatherwood Creek, the stream from the principal spring, not having so much gravel in its bed, does not go dry. In one of its upper branches I found the *Ancylus* before mentioned, and at the same place I found a single specimen each of *Pisidium abditum*, Hold, and *Limnæa numilis*, Say, the latter a dead shell, and the closest search did not discover any more of this species. Of the former however, after making a small sieve, I obtained hundreds in a short time.

These were the only species found at the Springs, but in the White River, a few miles away, in addition to the *Unios*, I found, *Melantho decisa*, var. *integra*, *Sphærium sulcatum* Lamarck, *Pisidium compressum*, Prime, *Planorbis bicarinatus* Say, *Physa heterostrophe*, Say, and several species of Melanions, of which two were *Pleurocera* and the others *Goniobasis*, they being found in great abundance.

The land shells were not found in large numbers, but more of them were rare species. During the dry weather the larger helices were found on the under side of the rocky ledges which extend on either side of the valleys and ravines. *Helix albolabris*, Say, was comparatively abundant, and on the highest ground was smaller, heavier and darker than those found lower down. On the higher grounds were also found *Helix thyroides*, Say, *Helix exoleta*, Binn, and the fine rare *Helix divesta*, Gould; none of them being found except at the highest points. Other rare species were *Helix labrosa*, Bland, *H. jacksonii*, Bland and *H. dorfenilliana*, Lea, variety, all of them being confined to the higher grounds. The latter is the variety of which Binney says, "I am much inclined to consider this a distinct species, but remark upon it, as I believe it is more commonly found in cabinets under the name *dorfenilliana* than the shell described by Lea." *Helix Perspectiva*, Say, was found in considerable numbers

a few, or in some cases a single specimen of the following were found: *Hyalina arborea*, Say, *Macrocyclos concava*, Say, *Helix alternata*, Say, *H. inflecta*, Say, *H. labyrinthica*, Say, *Bulimulus dealbatus*, Say, *Pupa armifera*, Say, *Zonites fuliginosa*, Griff., *Succinea* —, and *Helicina orbiculata*, Say. A small variety of *Helix fallax*, Say, was not uncommon, which was about half the size of the typical shell. I found a few albino specimens of it. On the cliffs of White River, *Helix roëmeri*, Pfeiffer, was obtained in small numbers.

There may be a few other species, but the total, not including the *Unios*, is not far from thirty-five, a number much smaller than is found in many localities, but places in the north or east will not give as many desirable additions to the average collection, nor furnish as many opportunities for studying local variations of species, as this will.

FLOATING STONES.

BY CHAS. H. STERNBERG.

I was much interested in Mr. Hanks' article on "Diatoms" in the November number of the REVIEW; especially the item on bricks that float. I once discovered a stratum of light-colored chalky clay stone, twenty feet thick, filled with the impressions of the dicotyledonous leaves, seeds and fish bones. I noticed that it was very light and, an object in the river attracting my attention, I threw a piece of the stone at it, and saw it float down the river.

Renewed experiments proved that there was no mistake; all the fragments, small or large, thrown into the river floated off like pieces of wood. Did not the ancients, perhaps, learn the art of making floating bricks from such deposits as I have described? This formation is on the John Day River, eastern Oregon, twenty miles below Cañon City.

The distinguished Russian geologist, Prof. G. de Helmersen, has prepared an elaborate report upon the coal fields of Russia, from which it appears that the annnal output of coal in the empire, though larger than it has ever been before, is estimated at only about 3,000,000 tons. The discovery, however, that the mines at Kamenskoe, which were only lately declared to be exhausted, are in fact the starting point of a vast region rich in coal veins and traversed by the Siberian Railway, is expected to produce very important results.

ARCHÆOLOGY.

ARCHÆOLOGICAL EXPLORATION OF THE MISSOURI RIVER.

In the early part of October, of the present year, the Kansas City *Times* inaugurated an archæological expedition down the Missouri River, the results of which have been published in nine articles contributed by Judge E. P. West to that paper, during the investigation. The Judge made the descent of the river from Kansas City to St. Louis in a skiff, examining the country adjacent to the stream on both sides. No research in this important field of investigation, heretofore undertaken in the State, has been so extended or so important in result as this one, if Judge West is correct in the facts detailed and the conclusions he draws from them. A brief summary of his work would not perhaps be uninteresting to the many readers of the REVIEW or an unimportant addition to the many interesting articles it has heretofore published on the subject. The Judge seems to have formed the opinion, pending the voyage, that different races which were hostile to each other occupied the different banks of the river and that their respective empires were widely extended. But the facts and the conclusions he draws from them will appear as detailed in this summary of them.

In considering the mounds and other antiquities on the south side of the river, Judge West says: "On a point at the intersection of the Missouri River and Blue River valleys, and overlooking them, stands a lone mound five miles east of Kansas City. This mound keeps vigil as a solitary and silent sentinel at the western empire which struggled through its part in human evolution and passed out of existence long before the European intruded his restless energy upon this continent.

"All the way down the Missouri River from this point to as far as I have yet examined (Miami, in Saline County), mounds precisely similar prevail. Rock Creek, Blue Mills, Sibley, Napoleon, Wellington, Lexington, Burlin, Dover, Waverly and Miami can all lay claim to mounds in their environments. They number by the hundreds, and stand on almost every high point on the south side of the river, or those at least commanding the finest views—silent witnesses of past empire and a lost race. They are very symmetrical in structure and vary in size from forty to sixty feet in diameter at the base and from six to ten feet in perpendicular height. No stone appears upon the surface, as in the chambered mounds on the north side of the river, and it is probable that no stone chamber is built in any of them; certainly there is none in those that have been opened. In fields where the mounds have been plowed over, fragments of pottery, flint chippings, and sometimes small burnt stones are thrown out by the plows.

XUM

Stone implements and broken pottery are found in the vicinity of all of them, especially in plowed fields, worn roads, and washes. Few of them have the appearance of having been opened or disturbed in any way. I ascended the bluffs in more than fifty places on my way down, and invariably found mounds; but in consequence of the almost incessant rains I was unable to open any of them west of this place. But for the past few days the weather has been more favorable for my work, and it is fortunate that the favorable weather conspires with a rich field for investigation. In the vicinity of Miami is one of the most interesting fields to the archæologist to be found in the State. In its vicinity events of the most thrilling interest occurred, associated with an extinct race, whose very existence would be unknown but for the silent monuments fashioned by it, and which it has left behind, of earth and stone, in the greatest profusion. Here, in addition to the mounds strewn all along the river above, there are other mounds of a different character."

After an elaborate description of the country about the Pinnacles, in the same article, Judge West continues: "The Backbone continues very narrow, indented with deep ravines on either side, back for the distance of about a mile, where it sends off a spur to the south and begins to widen and swells out into a very high and gently undulating plane stretching away for miles across the country. The spur, like the Backbone, terminates at the valley in a very sharp and abrupt point elevated some two hundred feet above it and is too steep for ascent. It continues very narrow back for about a quarter of a mile, where it widens out to two or three hundred feet, at the summit, and continues back about this width for another quarter of a mile, where it begins to widen and gradually widens back to its intersection with the Backbone, at a distance of about another half mile.

"On this spur, about a quarter of a mile back from its terminus on the river valley, stands a wonderful work, known as the "Old Fort." It consists of intrenchments thrown up on the verge of the summit of the ridge on both sides. The intrenchments are still from two to three feet deep, and are on either side one thousand one hundred feet in length measuring through the centre from end to end, and inclose an area from two hundred to three hundred feet wide, the trenches following the curvature of the summit of the ridge. At the sides there is but a single trench, but at each end there is a double defense closing the trenches except leaving a pass-way about fifteen feet wide. Near the centre of the work a single trench is thrown up connecting with the main trench on either side, with a pass-way in the centre of the same width as those at the ends. There are four small mounds in the works, which were opened last summer by Mr. Middleton, of Kansas City. Two of the mounds stand at the north entrance and to the right of the pass-way as you approach from the north, and two of them are near the centre cross intrenchments to the left of the pass-way as you approach from the same direction. Mr. Middleton found human bones, broken pottery, and flint chippings in the mounds. The bones were very much decayed. The pottery is precisely the same as that found in the fields in the vicinity. The trees growing in the intrenchments are of the same age as those in the adjacent forest.

I measured the stump of a white-oak which had grown in one of the trenches, but had been cut down several years ago. It measured three feet and a half in diameter two and a half feet above the roots. In other parts of the trenches, red-oaks more than three feet in diameter are still standing. There are three or four mounds near the intersection of the spur with the main ridge. From a half to three-quarters of a mile from the earthworks and on a line parallel with the west side, there begins an area of country extending to near the terrace before mentioned, a distance of about two miles and which is about the same width the other way. This entire area is literally covered over with low mounds, containing wood ashes, stone implements, pottery, mussel shells, and animal and human bones. Indeed the whole ground seems to be filled in this way.

"I dug into two of these mounds, in the field of Mr. Casebolt—they extend over four or five large farms—and for a depth of five feet I found successive layers of wood ashes and clay filled with broken pottery, flint chippings, bones and shells. The bones were those of birds and animals. But Mr. Casebolt, on the same farm, had a cellar dug under a part of his house after it was built, and in digging, at a depth of about three feet, two human skeletons were found side by side, buried extended in a horizontal position at full length. The bones were said to be very much decayed, and crumbled upon exposure to the atmosphere."

In his fourth article, in continuation of the antiquities at the Pinnacles and the history and tradition claimed by some to be associated with the "Old Fort," Judge West says: "The effort of the human race to attain a higher and better condition, is a matter of the deepest concern to all reflecting persons, and man's early struggle for good, in the race's infancy, are no less important than his efforts in a more advanced condition. In the grand problem of intellectual advancement every step is alike interesting and must stand upon a common level in the highest consideration of the great question. We find monuments of the humbler efforts of man, in his primitive condition, mingled with the work of the higher civilization of to-day, but they are fast fading away under its relentless incroachments. Each succeeding race, in its advance, destroys the work of the preceding races. As we are ruthlessly obliterating what has preceded us in human endeavor, so in the time to come, a grander enlightenment will still further make the forces of nature subservient to it and will efface the efforts of to-day with an equally relentless hand. But as our race has had its infancy, so too, it must have its time of decrepitude and old age, and in the grand mutations of time, pass from the world's evanescent stage.

"In my last article I promised a further account of the antiquities about Miami, and a notice of history and tradition attempted to be associated with the "Old Fort." The work of the race which forms so conspicuous a feature in the vicinity of the "Pinnacles," true to the law of the survival of the fittest, is rapidly passing away under the arts of civilization, and unless preserved by some friendly hand, will, ere long, be totally obliterated. Each succeeding year, as time moves on, the plowshare still continues to throw down its monuments. But to my promise. Those who associate history with the old fort, claim that it was constructed

by some of the early French or Spanish expeditions along the Missouri River. Some say it is Fort Orleans, construrted about 1720 by Captain De Bourgmont, who afterward, about 1725, assigned the command to his sergeant, Du Bois, who was made a captain. The history of this fort is somewhat romantic, owing to the marriage of DuBois to a princess of the tribe with whom the Spaniards were allied, and his subsequent massacre, with that of his entire command, not one being left to tell the sad story or the causes which lead to the tragedy. But the same history which tells this tragic tale contains facts which render it highly improbable that the earthworks at the Pinnacles could have been Fort Orleans. The expedition, according to the historic account, was undertaken in 1720 and only consisted of thirty men, and two officers. Five years after, the command was assigned to Captain Du Bois with no greater force at his disposal. The Spaniards were at peace with the neighboring tribes, and their ultimate destruction was not by an outside foe, but by the people with whom they were living on the most intimate terms. The fort is said to have been a stockade and was burned to the ground. The stockade was the most usual mode of defense against Indians of that day. There is no appearance of a stockade having existed about this old work at the Pinnacles. Thirty men would be wholly inadequate to the defense of more than 2,200 feet of intrenchments, and such a work was unnecessary for their Indian allies, as they were all friendly with the neighboring tribes. The trees in the intrenchments, which have grown up since the work was constructed, are certainly older than the date given for the Fort Orleans expedition. There is no water nearer than a quarter of a mile of the intrenchments, and, on the narrow ridge upon which they are constructed, water could not have been procured by digging under from one hundred to two hundred feet, and it is not likely that thirty men would undertake so extensive a work where the nearest water supply was more than a quarter of a mile distant, especially when there were numerous other places in the neighborhood more available for the defense of a small force.

"The tradition attempted to be associated with the work is still more romantic, and, if true, is stranger than fiction, and would unfold a chapter of heroic struggle unparalleled in the world's history. The tradition runs in this wise: That when Francisco Pizarro invaded Peru in 1531 a party of the native Peruvians, consisting of three hundred men, to save their church treasure and consecrated vessels from the sacrilegious hand of the Spaniard, took them under their care and proceeded north with their sacred trust. And after many encounters with the wild tribes along the line of march, and after many months of privation and hard travel, they finally reached a great river, which is claimed to have been the Missouri. Here they halted, but were surrounded by wild and hostile tribes. They erected a fort as a defense against their enemies, in which, it is said, they buried the vast treasure in their charge, and after a few years of painful struggle against their inferior but more numerous foe, were exterminated by their enemies. This tradition is based upon the story of a Portuguese and his buffalo robe. It is said that many years ago, when St. Louis was but little more than a village, a Portuguese, having in his possession a buffalo robe with historic picture writing

upon it, visited that place and spent several years there before revealing his mission. The strangeness of his conduct excited general notice and induced him, when he gave up the search, to impart the secret of his mission to one man. The remarkable feature about his conduct was that he made it his sole business to hunt out every Indian trader and trapper who visited St. Louis, and especially those from the Missouri River, and inquire of them for a certain country described by him and which, it is said, corresponds exactly with the Pinnacles and the mysterious "Old Fort." And in further confirmation of this tradition a vast amount of digging has been done at different times to find the buried treasure. But, so far, all efforts in this direction have been failures and until the treasure is found it would not be safe to attribute the work to this little band of heroes and martyrs to Spanish cupidity.

By whom, then, was the work constructed? Evidently, by those who occupied its immediate environment when the work was done, the people who erected the mounds now standing in its vicinity. Everywhere around the intrenchment is evidence of a former dense population and a long continued occupancy of the country by a people capable of doing the work. No one who has studied the work and its immediate surroundings can doubt for a moment that it was the achievement of this people. The trees growing in the intrenchments, and which have sprung up since it was made, are evidently older than any known European expedition on the Missouri River, and perhaps were growing, some of them at least, when Columbus first rejoiced in the success of his discovery of a new continent.

"It will be remembered, too, that I stated there was an area of country more than two miles in extent each way, extending to near one end of the terrace and approaching to within a short distance of the "Old Fort," which is literally covered with low mounds. This district may very aptly be termed a city in ruins. The ground for a depth of from three to five feet, or more, is filled with the bones and domestic implements of a departed race, and for miles around their broken implements lie scattered everywhere. They were undoubtedly a people who had a fixed and permanent abode, and an agricultural people, to a limited extent at least, for some of their stone implements must have been made for the cultivation of the soil. They must have used their pottery vessels for cooking their food, and the low mounds represent their kitchens, in which wagon loads of broken vessels might be gathered up—broken at the domestic hearth.

"The intrenchment seems as old as some, at least, of the vestiges of this lost race, living around it; and all may be relegated to the same people, and to a time since, and not very remote from the close of the loess deposit, or to a time, at least, when but little if any vegetable mold was formed upon it, for their implements now found certainly rest upon the loess and underneath the black soil. A people with a fixed abode and who had made the advance toward civilization of those who erected the mounds and manufactured the pottery found in the environments of the "Old Fort" were capable of constructing such a work, and every thing points to them as the authors of it. And as it is manifestly older than

any known, or even probable, European expedition along the Missouri River, we must assign it to prehistoric time and a prehistoric people.

"The State, or some scientific association of the State, ought to purchase the land upon which this mysterious, "Old Fort" is situated and preserve it as left by its builders. We should snatch one little spot from the hand of cupidity and the ravages of time and hold it sacred to the past and the memory of a lost race."

For fear of drawing too heavily upon your space in the present number, I will ask to continue this summary in your next one.

PALÆOLITHIC.

KANSAS CITY, December 15th, 1881.

DR. EDWARD PALMER'S RESEARCHES IN MEXICO.

Mr. Putnam said that it gave him great pleasure to call attention to the important work which Dr. Edward Palmer had done in Mexico, while acting under his direction for the Peabody Museum of Archæology at Cambridge. Dr. Palmer had recently returned from the southwestern portion of Coahuila where he had been, notwithstanding many difficulties, very successful in exploring several caves that long ago were used as burial places by the Indians of that region. These burial caves have been mentioned by a few writers, and stories have been told, by people who visited them or heard of them, nearly half a century ago, of the immense number of human bodies that they contained. Since then the caves have been, unfortunately, pretty thoroughly worked over for nitre, and it is said that thousands of the "mummies," as the bundles of human bones are called, were used for fuel by the nitre workers. Dr. Palmer, however, after considerable search in several caves, had found in their deep recesses a number of the bundles that had not been disturbed and these he had brought to Cambridge, where they had been carefully opened and their contents and wrappings arranged in such a way as to keep all belonging to a bundle together. Each bundle, it was found, contained the bones of one or more human skeletons and various objects such as ornaments, implements, small baskets, sandals, and articles of clothing. The great resemblances of these "mummies" with those found in the caves in Kentucky and Tennessee is of particular interest. Mr. Putnam stated that he considered the collection one of great interest and that a detailed account of it would be given, in which Dr. Palmer's notes would be incorporated.

Dr. Palmer then exhibited a small portion of the collection, including a number of pieces of cloth which were beautifully woven from agave fibre, also cords and bands made of the same fibre, baskets which were probably used as food vessels, large stone knives that were fastened to short handles of wood, shell and bone beads, a necklace made by stringing the vertebræ of a snake on several pieces of soft cord, portions of a fringed skirt, on the edge of which feathers had been fastened, a feather head-dress, braided sandals, and many other interesting objects which were found in the bundles. Some of the pieces of woven cloth

were eight to ten feet in length and about four feet in width, and were not only finely and evenly woven, but were also of several different colored patterns. While explaining the different specimens, Dr. Palmer made many interesting remarks upon Indian life of the present time, and compared some of the ancient remains from the caves with similar things used by the present Indians. Many of the things, however, which were found in the bundles were not like those used by the Indians of the present time, and from this fact and from the few inches of cave breccia which had formed over the human remains, and contained thousands of bones of bats and small rodents, Dr. Palmer thought there could be no doubt as to the bodies having been placed in the caves long before the Spanish conquest of the country, and he stated that not a thing derived from the Europeans had been found in the bundles, nor, so far as he could learn, in any of the burial caves.—*Proceedings Boston Society of Natural History.*

ON THE MOUND-BUILDERS' KNOWLEDGE OF METALS.

BY WM. H. R. LYKINS.

I notice that Prof. Reid is being criticised for the statement made in his article in the November number of the REVIEW, that a fragment of a mound-builders' axe found by him had been molded. Now, while it is hardly to be supposed that the Indians or "Mound-Builders" had attained such a knowledge of metallurgy as to mold their implements and ornaments of copper, yet it is not so improbable as it may at first seem. A lump of melted metal, or even soft clay, falling into an indentation or cavity would take the form of that indentation, and from such a simple occurrence the Indian or "Mound-Builder" might conceive the idea of molding in a rude way his hatchets and other implements. Many years ago, when residing among the Indians of Kansas, I remember to have seen the young men make small ornaments by cutting figures in wood and filling them with melted pewter or lead, using a *wooden* ladle in which to melt the metal. A bowl-shaped cavity, with a lip or channel on one side, was cut in a very green piece of wood; the metal broken up and placed in the cavity, and a fire of hot coals placed upon top of the ladle, instead of under. In this rude and primitive way very passable figures of turtles, birds, horses, etc., were made. I have also seen handles of tomahawks and war-clubs very handsomely ornamented with geometrical figures in silver, in the same way using their old worn-out ornaments of silver for that purpose. But whether the idea of molding was original with them or whether they had learned it from the whites, I never thought at that time to inquire. The question is one of some interest to archæologists, and no one can yet say positively whether the Mound-Builders did, or did not, use molds, until further investigation has thrown more light upon the subject. Yet it does not seem improbable that a people who had become so proficient in the art of

making pottery as their remains show, should not have acquired some knowledge of molding.

The great difficulty in the way of their attaining and using such knowledge was the paucity of metals with which they seem to have been acquainted, native copper, which is easily worked in its natural state, being the only one. It is more surprising that they never discovered the use of lead—a metal so easily reduced and manipulated, and found in so many places throughout our country. Even a fierce forest fire of fallen timber burning on an exposed vein of Galena would reduce some of it to a malleable state, and thus attract their attention; but so far as we know few if any implements or ornaments made of this metal have been found among the Mound-Builders' relics.

ENGINEERING.

THE MISSISSIPPI LEVEES—HOW BUILT AND HOW REPAIRED.

Above the confluence with the Ohio the Mississippi Valley has more of the commonly accepted conformation of a valley, the land sloping on both sides toward the river, forming a basin. But from the Ohio downward one has to go miles away from the river before reaching the sides of the valley, there being many thousands of square miles of land which are of an almost floor-like level, only sloping gently southward toward the gulf. Over this floor the river has, with its sediment, built itself a great roof-shaped ridge, and along the ridge-pole of this roof, so to speak, the greatest stream in the world pursues its crooked course. As water seeks the lowest level, of course when the river is high the tendency is to "slop over" and flood vast regions of the river lands on either side. Were it not for this elevated position of the Mississippi, the damage wrought by the floods would be comparatively local in extent, but, as it is, between 32,000 and 37,000 square miles of alluvial territory are liable to inundation when not protected. Scientists tell us that within comparatively recent times, geographically considered, but still long before the discovery of America, this vast alluvial ridge, together with the delta, did not exist, and the "Father of Waters" ran, a clear, limpid stream, from its source to the Gulf. But by some change in the surface-covering of the country—probably the destruction of the trees throughout the vast plains of the valley by the aboriginal inhabitants, converting them into open prairies—the land was exposed to the attacks of the waters, and the Mississippi was made a turbid stream, carrying each year hundreds of acres in a liquid form, either to be superimposed upon the level lands along its course, or to be built out into the Gulf, the fresh-water invader thus conquering new areas of land from the salt sea.

To protect the valuable lands along the exposed part of the river gigantic systems of levees have been made necessary, forming a length, on one side or the other, of about 1,800 miles, and representing in first cost and present value $20,000,000. But even the present system is regarded as entirely inadequate, for the levees, which are constantly breaking or threatening to break, protect but a comparatively small strip along the main stream and its principal tributaries, whereas by protection against overflow, and by proper drainage, an enormous expanse of what is now waste swamp land would be brought into cultivation—a stretch of country beside which the areas reclaimed from the sea in the Netherlands sink into insignificance—while the work of reclamation, gigantic as it would have to be in relation to its results, in the amount of time and labor required, would be comparatively small beside the work of the industrious Dutch. There would thus be rendered available along the Mississippi not less than 2,500,000 acres of sugar land, about 7,000,000 acres of cotton land, and 1,000,000 acres of corn land, all of unsurpassed fertility. On the eastern side of the river is the great swamp of Mississippi, fifty miles wide, extending from just below Memphis to Vicksburg, 170 miles in a direct line and nearly 400 miles along the river. On the other side is another vast and fertile region, embracing the lower part of Missouri, all the alluvial front of Arkansas and of Louisiana as far down as the mouth of the Red River. This land is not so favorably situated for reclamation as that on the eastern side, where there is no tributary of the Mississippi until the Yazoo is reached, within a few miles of the Walnut hills, near Vicksburg. But on the west side are a number of tributary streams, themselves all liable to overflow, while all are subject to back-water from the Mississippi, which would make levees necessary as far as the line of back-water extends. Much fine land, however, has been reclaimed here, although the line of levees is more fragmentary than on the other side. Below the Red River there are no tributaries entering the Mississippi, and on the other hand the waters are depleted by numerous outlets to the Gulf.

The levee system of the Mississippi in its beginnings is comparatively ancient, having been started in Louisiana in the early part of the last century. But in Mississippi and Arkansas the reclamation of the swamps is of modern date, having originated almost within the memory of living persons, and having been at first the work of individuals, unassisted by the State, which, from an early period, assumed the control of the matter in Louisiana. The first plantations on the Mississippi, between Memphis and Vicksburg, were established upon knolls, which, although the product of the floods themselves, gained the reputation of being "above overflow," because they had not been submerged for a number of years. Being very rich, they came into great favor as cotton plantations. But finally unusually high water came and dispelled the delusion about their security. Once in possession, however, the planters were naturally reluctant to abandon such rich lands, and means were devised to keep out the water. Water marks left upon the trees and other objects indicated the highest points the water had ever reached and supplied the place of engineering knowledge in telling how high to

build the levees. Makeshift levees of primitive style were thrown up close to the river bank in order to save the land for cultivation, and also because the ground was always highest upon the river margin. As the plantations became more numerous, and approached each other, co-operation came into play, and levees were built for a long distance across the river front of several plantations. The levees thus built were of slight construction, but they afforded ample protection for a number of years. But in 1844 the river rose unusually high, and all the levees were destroyed, making it evident that more substantial methods of construction must be introduced. State aid was called in for the first time. Levee Boards and other similar bodies were organized; funds were raised by local taxation of lands; professional engineers were consulted and employed, and, the negroes not being skilled with the spade, armies of Irish laborers were drawn into the service.

Much of the work was necessarily temporary, the unbridled river carrying away huge slices of its banks in the most unexpected places. Therefore it was necessary either to renew the levees frequently or place them far back from the river, and out of its reach if possible. But this made the land in front worthless for cultivation, and violent controversies were thus brought about between planters and the Levee Board, the former naturally objecting to being deprived of so much of their best land.

The primitive levee, as built before the days of civil engineers and Irishmen, was an embankment sloping from the surface at an angle of forty-five degrees to a foot or two above high-water mark. Ground was thrown up from each side, making an irregular ditch at each base, two spades deep, and usually full of water. Whenever the river rose against the levee, the "transpiration water" which oozed through and filled the trench behind, made it difficult to get at levee for work in case of emergency. The levee was directly upon the natural surface, stumps and even logs were left in it, leaving places where dangerous cavities for the passage of the insinuating water were certain to form. Sometimes the levee, built directly upon the surface, would slide away from the pressure of of the river.

The improved mode which followed was, first, to clear the space to be covered by the levee entirely off, removing trees, stumps, roots, logs, weeds, and even grass and leaves. A so-called "mock-ditch" was then dug the whole length of the proposed work, three feet wide and of the same depth. This was straightway filled up again. The object of this was to close all root holes and to mortise the superstructure into the natural earth, thus preventing any sliding away. The loose earth thrown up for the building of the levee, and filling the ditch in settling, naturally formed a uniform mass more solid than the natural earth. The levee, by this construction fitting into the ground as two matched boards fit together, was thus securely anchored. In building the levee according to the improved method the material is only taken from the ground outside, toward the river, and at least twenty feet away. The earth is carried on wheel-barrows upon run plank. The dimensions vary according to the

available funds. But it is a rule to make the top three feet perpendicular above high water mark, to top level, and as broad as the levee is high. The height, of course, varies according to the level of the natural bank above the river. The last step in the process of construction is the "seep-water ditch," dug something like thirty or forty feet from the inner margin of the levee, and, running parallel to it. This is to carry off the water oozing through even the most compact of levees. From this ditch the water is conducted off to the swamp in the rear. As a finishing touch the levee is planted with Bermuda grass, which in a short time will cover it with a dense sod and add greatly to its strength, enabling it to resist the abrasion of the water. The season for building lasts from October through the winter until the spring rise puts a stop to the work. The laborers are collected by contractors in St. Louis, Cincinnati and other up-river towns, and are chiefly Irish, with a few other nationalities mixed in. When the season closes, all except a few return to the upper country. The work is paid for by the cubic yard, usually from 25 cents to 35 cents a yard. The cost varies with the dimensions, a good seven-foot levee with ample base costing from $8,000 to $11,000 a mile, the higher costing in a much greater proportion and the lower in much less.

The season of the highest water, which is that of the greatest peril to the levees, is variable, and ranges from April 1st to July 1st, sometimes coming earlier and sometimes later. It depends greatly upon the winter in the upper regions; a mild winter brings an early flood, while a hard winter delays it by keeping the rivers above closed with ice. The most dangerous floods come from the Ohio and its branches. The Upper Mississippi and Missouri have not nearly such a power for evil. This has reference to the effect upon the Lower Mississippi. The recent October floods that have wrought such damage were upon the Upper Mississippi and its tributaries, above the region of the levees.

The breaks of crevasses are rendered more easy of repair as they increase in width. This diminishes the force of the water, and when it falls below the strength of the material forming the levee the abrasion ceases. Sometimes the destructive work is limited through securing the ends of the levee by driving down heavy stakes and depositing masses of gunny-bags filled with earth. Sometimes a thicket of willows or other trees, or even a chance log, masking the critical point, accomplishes the same result. The closing of a crevice becomes practicable when the river has so fallen, or the overflow water within has so risen, as to diminish the current to allow the driving of a line of stakes across the break. With the diminishing width the greater becomes the difficulty. A crevasse closed in time, and with comparatively slight expense, will often save hundreds of thousands of dollars worth of property. Gunny-bags are the best things to stop a crevasse; they are rather costly, but it pays to have them on hand. Other materials for stopping a breach are stakes, boards, brush and earth, the latter both in bags and loose.

XUM

The damage caused by an overflow consists chiefly in the loss of time and the injury to the crop prospects, for it is, of course, impossible to plant until the land has been drained of the water. Cattle are often drowned in large numbers, but buildings are rarely injured, for the water of the overflow is generally current less. It is rarely that a break occurs directly in front of buildings. Breaks are often occasioned by the borings of crawfish, which honey-comb the levee and let the water through. Another danger is an exposed position to a long sweep of the wind down the river for several miles, dashing the water against the levee with great fury. The first land to suffer from a break is that farthest away from the river, down toward which the water flows. If there is no outlet down the valley for the water it will gradually back up toward the river, filling all the space with a great pond. The land close to the levee, being the highest, is the last to suffer.

The greatest flood ever known on the Mississippi was that of 1844, which swept away all levees, overflowed the entire country, filled up the swamps, remained at high-water mark for months, until the middle of July, and did not finally retire until nearly the middle of August. The flood was owing to the unscientific construction of the levees, and would be hardly possible since. William L. Murtree, Sr., gives a graphic description of the flood in *Scribner's* for July: "The shallowest water, for indefinite miles in any direction, was two feet deep, the nearest land 'the hills of the Arkansaw,' thirty miles away. The mules were quartered on the upper floor of the gin-house; the cattle had all been drowned long ago; planter, negro and overseer were confined to their respective domiciles; the grist-mill was under water, and there was no means of preparing corn for culinary purposes except a wooden hominy mortar. That year nineteen plantations out of twenty failed to produce a single pound of cotton or a single bushel of corn, and, when the flood was over, and the swamp Noahs came out of their respective arks, they were, to say the least, malcontent."

There had not been such a great rise since 1828, but that did comparatively little damage, for the country was then hardly inhabited. Since that time there has been no such universal damage, for the levees have not succumbed all together at any subsequent period of high water. But the injury, although scattered here and there is very great, for the country is now more thickly settled and productive. Millions of dollars worth of damage is annually done by floods in various parts of the Mississippi Valley. In 1871, in the Ouachita Valley alone, one of the tributary streams in Louisiana, the damage by a flood was $5,000,000. The flood of 1874 caused a loss of $13,000,000.

It is now proposed that the Government take the improvements of the Mississippi in charge and carry out comprehensive measures designed to prevent further floods. It is urged that this is a national matter, as the reclamation of such a vast area of the richest land would add immensely to the prosperity of the entire country. This area is as large as the States of New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut and New Jersey combined. Less than eight per cent of this area is now under cultivation. It is estimated that, if

protected and improved, these lands would be worth $2,043,858,251. As their present value is but $107,628,833, the increase would be a sum nearly equal to the national debt. It is therefore claimed that the returns would justify the outlay of the largest sum which the improvement would be likely to cost.

In 1874 a national commission recommended an elaborate levee system. As this was regarded as but a temporary expedient, the commission appointed under the law of 1879 considered more comprehensive plans. Chief of these are two which are designed to make a subordinate element of the levees, and possibly to make it possible to dispense with them altogether. One of these is called the "outlet system," and is designed to carry off the superfluous waters by making large and adequate outlets, possibly diverting the Red River so that it shall reach the gulf independently of the Mississippi.

The system recommended by Capt. Eads, who has the prestige of success, never having failed in anything he has undertaken, is the precise opposite, as he proposes to close all outlets, confining the water so closely that it would dredge out the channel, giving a uniform width, depth and velocity. He claims to be able to secure a channel twenty feet deep by this means, thus improving the navigation wonderfully and preventing all danger of floods. These benefits can be secured, he says, "for a sum entirely within the ability of the Government, and one really insignificant when compared with the magnitude of the benefits which would flow from such improvements."

The New York *Journal of Commerce*, in commenting upon the recent floods in the Upper Mississippi, commends the sentiments of a correspondent, who fears injury to the dwellers along the upper part of the stream by the proposed improvements below. The *Journal of Commerce* says art can not interfere for the most beneficent purposes with the natural channel or course of a stream without producing results different in some respects from those intended. Mr. Eads' jetty system of narrowing and deepening the Mississippi at points below New Orleans has not been in operation long enough to effect the injurious consequences which may yet be expected from it on the waters far above. But, if this plan is carried out on the enormous scale demanded by the St. Louis Convention, in parts of the river remote from its mouth, then the floods of the future cannot fail to be more serious than those of which complaints are now pouring in from the West. If the present unrestricted channel of the Mississippi is not wide enough to accommodate the waters of the freshet, it "stands to reason" that every dike, jetty and dam constructed for the purpose of narrowing the river must offer a diminished outlet for the superabundant water. There are others, however, who say that such objections as these have about as much weight as that of the wolf who said that the lamb drinking in the stream below him was defiling the water where he was—*Boston Herald.*

XUM

SOME GREAT ENGINEERING PROJECTS.

The shortening of commercial routes by means of ship-railways and ship-canals seems to be the great ambition of the engineers of to-day.

In addition to the De Lesseps Ship-Canal at Panama, the Eads Ship-Railway at Tehuantepec, the Florida Ship-Canal, the Chesapeake and Delaware Ship-Canal, the Cape Cod Canal, and others in the interior of this country, there are several other important projects of like nature under way or in prospect in various parts of the world. The old project of connecting the Bay of Fundy and Baie Verte, on the Gulf of St. Lawrence, across the Isthmus of Chignecto, has lately taken new form. It is now proposed to make the connection by a ship-railway eighteen miles long, thus making a short-cut for navigation between the United States and the ports on the St. Lawrence Gulf and River, and saving the long and dangerous voyage around Nova Scotia.

The projector of the ship-railway, Mr. H. G. C. Ketchum, writes us that the plan grew out of a desire to save lockage and a deep channel in the design of the Baie Verte Canal. His first plan was to lift vessels by hydraulic power on pontoons and then float them through the canal. The idea then occurred that they might as well be lifted to the surface of the ground and hauled across the neck of land on rails. The road may be level and perfectly straight from end to end. The plan has been submitted to the Dominion Government and is favorably entertained. Mr. Ketchum has issued an interesting pamphlet relative to the project, which may be considered at greater length elsewhere.

Across the ocean the construction of the tunnel under the British Channel, connecting England with the Continent, is being prosecuted with an energy which is indicative of ultimate success, and thus far no obstacles have been encountered to make the undertaking a difficult or exceptionally hazardous one.

In France, the connection of the Atlantic with the Mediterranean by a ship-canal, to save the long and stormy voyage around the Spanish Peninsula, is under serious consideration, and the Council-General of the Seine have just adopted a resolution approving of the project.

The ship-canal across the Isthmus of Corinth, in Greece, to shorten the route to Constantinople and the ports of the Black Sea, has, we believe, been definitely determined upon.

In the far East a bolder and more important project is in contemplation, with a view to shortening the commercial route to China and Japan by six hundred miles or more. At the head of the Malay Peninsula is the Isthmus of Kraw, connecting Upper with Lower Siam; and by the cutting of a ship-canal at this point, about thirty miles in length, the need of sailing around the peninsula might be obviated. At Kraw, the Malayan Peninsula, which stretches southward for five hundred miles to Singapore, is at its narrowest breadth, and the distance across from the side of the Indian Ocean to that of the China Seas is further decreased by the existence of natural water-ways for some distance inland

from both shores. From side to side it is no more than fifty miles, and the Pakchan River, on the western coast, and the Htassay on the eastern, afford the ready means of further reducing it. The distance, therefore, over which it would be necessary to cut a canal would probably not exceed thirty miles. The neighboring districts are known to be fertile and to contain great mineral wealth. A tin mining company has been established for more than ten years at Malewon, on the Pakchan, and gold has been found in the neighboring stream of the Lenya. So far as known the engineering difficulties are not of a stupendous character, and political drawbacks and considerations fortunately do not exist.

The French appear to have taken the lead in proposing this important commercial short-cut, and, if the opinion of the London *Times* is well founded, the Government of British India will not decline to actively participate in its execution.—*Scientific American.*

THE NEW TAY BRIDGE.

Plans for the new Tay bridge are now on exhibition in Edinburgh for inspection by intending contractors. The new bridge is to be built on the girder principle, four brick arches next the shore on the south side, each having a span of 50 feet; the girder work commencing with a span of 118 feet from centre to centre of the piers, is continued with ten spans of 129 feet and thirteen spans of 145 feet; this reaches the navigable portion of the channel. Here are eleven spans of 245 feet and two spans of 227 feet; the first four of these spans are 77 feet above high-water mark. From this point the bridge falls at a gradient of one in 114, there being one span of 162 feet, ten of 129 feet and six inches and one of 127 feet and six inches. The bridge is to be constructed for a double line of rails; foundation will be formed of wrought-iron cylinders filled with concrete, with brick-work eight feet above high-water mark. Two piers are then formed of wrought-iron pillars braced together, connected with each other near the top; the platform of the bridge is of wrought-iron.

UNDER-GROUND CABLES.

The telegraph pole and wire nuisance which prevails in all cities will probably soon be abated to a great extent. In New York and Chicago the wires are rapidly being put under-ground, and it is possible that the time is coming when the under-ground method of telegraphing will be in vogue all over the country, as it is now pretty generally in Germany. In Chicago four miles of this cable have been laid and the work is being pushed as fast as possible. Under-ground telegraphing has been a problem difficult to solve, and it is only recently that it has been brought to anything like perfection. The method in use at Chicago consists, in brief, of a cable made up of No. 12 copper wire, inclosed in a lead pipe, resting on a cov-

XUM

ered pine trough, and sunk into a trench three feet deep. The preparation of the cable is thus detailed: Each wire is first run through a glass tube an eighth of an inch in diameter. Twenty of these wires, each incased in its glass tube, are inserted in a lead pipe. One end of the latter is then tightly closed by slippling over it an air-tight "cap." A small opening is cut into the upper surface of the pipe, and the cut piece of lead turned back. It now remains to make the tube thoroughly air-tight and completely insulate the copper wires, and the way it is done is as unique as it is interesting. A hot solution of resin, tallow, bees-wax, and other insulating compounds is poured into the pipe at its open end. As the hot solution flows through the pipe it drives the air before it, and takes the place formerly occupied by the atmospheric fluid. The air, unable to find an exit at the closed end of the pipe, is forced up through the small opening cut in its upper surface. The solution continues to be poured in until the air is finally entirely expelled, when the lead cutting on the upper surface is thrown back into place, filling up the opening, and an exterior application of solder prevents the entrance of any air from the outside. The result is an air-tight lead pipe, filled with copper wire incased in glass tubes, and the whole arrangement is thoroughly insulated by the solution of hot resin, bees-wax, tallow, etc. The ends of the copper wires, however, are allowed to extend several inches beyond the lead pipe, in order, of course, that two connecting pipes, with insulated wires, may be properly joined together, and the line drawn out by the union of its several sections. The process of making this wire in every detail is interesting, and involves great care and nicety of execution, but when completed, turns out a pipe full of thoroughly insulated wires, and renders a break in the electric current impossible. The manufacturers of this wire are said to be crowded with orders, showing that the telegraph companies contemplate putting it into use at once in the cities, where the removal of the unsightly poles and wires is very desirable.—*Kansas City Journal.*

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, NOV. 22, 1881.

M. Pasteur's discovery for vaccinating live stock as a preservative against the *charbon* malady, has naturally awakened inquiry as to extending the application of the principle. Now, two distinct diseases are confounded under the same appellation of *charbon*, which, while having certain points of external similarity, differ widely fundamentally. In the case of the *charbon* fever, the disease was inoculable by the blood, while in the second, symptomatic *charbon*, it was the contrary. Both maladies have their origin in the animalcule of the microbe

family, but there is a difference in the species. When inoculation, for example, takes place with the microbe derived from the *charbon* symptomatic, a large tumor is formed, and carbonic acid generated in the interstices of the tissue—hence the tension and sonority of the tumor when struck; there is, however, nothing putrid, for when the tumor is opened only the gas mentioned escapes. Hence, there is an affinity between contagious fermentations and those that take place external to living bodies. A second difference between fever *charbon*, which produces hardly any tumor after inoculation, and the symptomatic is, that in the former, when the microbe is introduced into the blood, fever is rapidly induced, ending in a short time fatally. In the latter, the microbe produces but a moderate and ephemeral fever, never fatal, but not the less so profoundly affecting the system as to protect the animal against death, as the injection into the veins of animalcule confers immunity on the beast. Professors Arloing and Cornevin have identified their names with the method of inoculation for the symptomatic dissease, and which preserves the animal from the contagion; their experiments have taken place in public, and with uniform success; stock vaccinated lived; stock non-inoculated, died. M. Pasteur's method consists in specially preparing the virus or pock by artificial means; the Professors take the virus in its natural state, and inject it directly into the veins—it becomes mortal if introduced into the tissues—the blood thus forming the medium for changing the virus into a vaccine; that is where their process differs from Pasteur's, and which is tantamount to a real discovery. Professors Arloing and Cornevin are also of opinion, that a cow inoculated during the early stages of gestation, can confer immunity on the offspring. Often an animal not inoculated, but living with animals that have been, escapes contagion; this is presumed to be due to spontaneous vaccination. Farmers having asserted, that cattle when over three years old escape the symptomac *charbon* disease, the Professors tested the tradition by experiment and found it to be correct.

Is there any antidote against the venom of serpents? Up to the present caustic potash was considered an efficacious remedy. According to M. de Quatrefages, M. de Lacerdo, of Rio Janeiro, finds permanganate of potash absolutely a perfect antidote. Dogs, into whose tissue or veins, the virus of serpent poison had been introduced, died more or less rapidly; but others invariably lived if dosed with permanganate. This would appear to corroborate the views of M. Pasteur, viz: the oxidation of venom modifies its toxical qualities. It is to be hoped the experiments will be pushed to find an antidote against rabic virus.

Game, birds especially, possess a flesh very appetizing, fine and energetically reparative, which is easy to digest, and suits well-debilitated stomachs; the same cannot be said of venison, wild boar, etc. though possessing savory flesh, they are exciting and heating. Game provokes the stomach to energetic action, inducing the coats to secrete abundantly; it remains longer too in the stomach, is more completely acted upon by the economy of digestion, and is largely assimilated by the system, enriching the blood, and imparting stimulus and life to the organs. However, a regimen composed exclusively of game, would ultimately prove as

XUM

detrimental to health as one solely limited to fish: constipation, headache, congestions would ensue. Besides, of all flesh aliments, game is what soonest fatigues the stomach. Formerly pheasants were much employed for invalids, but then such ought to be young and tender; eaten too soon, the flesh is hard and leathery; eaten too late, it is indigestible. When doctors recommend pheasant to convalescents, it ought to be served roasted and a little ripe; however, stomachs even those *sans peur et sans reproche*, as well as those less robust, ought to even remain on guard against a meat when in a state of decomposition. Partridge is the best of all game, either for the healthy or the indisposed, in point of alimentation; its flesh is easily digested, and it demands not to be "hung" to become agreeable; the red is preferable to the grey partridge; for the sick nothing can be superior to an old partridge converted into broth; although boiled and served with cabbage being the favorite form in which partridge is served, on the continent at least, yet it should be roasted for convalescents. In ancient times quails were said to produce epilepsy; at least Pliny, who ever had a weakness for the marvelous, and introduced a good deal of romance into natural history, prohibited the eating of that bird, because it fed on venomous plants, and, hence, was subject to epilepsy. The flesh of the quail about harvest time is very delicate and savory; its fat being difficult of digestion, causes it to be less in favor for invalids than the partridge. Woodcock is ranked by sportsmen above partridges, when young and fat, its flesh is very savory and of delicious taste, but as it requires to be hung, to develop its qualities, it is thus excluded from regimens for the sick. Brillat-Savarin has asserted, a woodcock should be ever roasted under the eyes of a sportsman, and above all, the sportsman who brought it down. Ordinarily it is so richly cooked as to recall the old adage: "we live, not by what we eat but by what we digest." Snipe is preferred by not a few to woodcock, as being more delicate; after the first frosts, it is an exquisite table bird; its flesh is digested readily, and not requiring keeping, like all water-fowl, it suits well the sick; if abused, snipe would prove an exciting food. Wild duck possesses a peculiarly fine taste, and is very superior to its domestic namesake, which is absolutely unsuited for the gastralgic and the dyspeptic; yet with all its advantages, wild duck should be avoided by convalescents. The Romans held peculiar views about ducks, partaking only of the head and breast, the remainder being, according to Martial, destined for the cook's perquisites. The best form in which to eat wild duck, is that of the *pâte d' Amiens.*

Boulogne-sur-Mer it seems, was a shade too hasty in perpetuating, in the form of a statue, the claims of Frederic Sauvage, as the inventor of the screw-propeller. Professor Govi, of Naples, has irrefutably shown, the honor reverts to Leonard di Vinci, who in the fifteenth century applied the screw to propel light paper machines in the air; it was a hobby with the great painter to discover the means to fly, and he wrote some remarkable articles on bird-flying; he even contemplated an apparatus destined to enable man to mount into space. Drawings

of di Vinci's screw-propeller exist in the National Library of Paris, as also those of his machines for aërial navigation.

The Congress of electricians in its twenty days sittings, has done good work by adopting unity of views and correlating common results. Science will gain the first by this homogeneity, and next the public. It has unified the standard of electric measures, so as to express in a uniform manner, and according to the decimal system, the force, the intensity or volume, and the resistance of an electric current. M. Denayrouse made a warm appeal to the partisans of electricity to unite to secure the full benefits of electric discoveries. The obstacles to the practical extension of these benefits, are statesmen and municipal councils, aided by no less than twenty different inventors, each claiming the pre-eminence for his own system. Were these social impediments conquered, there would be no difficulty in transmitting electric energy like gas, and transform it into light and mechanical power, and so enable workmen to toil, not in a factory, but in the bosom of his family. M. Siemens executed a most brilliant experiment; he arranged a crucible in a certain position, placed therein fragments of steel, placing over same the perforated cover; the two currents furnished by an electromotor wired, one at the top the other at the underneath, part of the crucible; in fourteen minutes the mass of steel became red hot and melted, and the quantity of fuel expended to work the electro-generator was less than what would be necessary to secure fusion by the direct application of heat. The mass of metal as melted by M. Siemens, presented no blisters.

Attention remains unabated relative to the subjects of electric domestic lamps, and I might add, domestic and portable electric motors; the latter appears to be but a question of cost, the former but of choice. The Maxim lamp has undoubtedly become a favorite with the public; it is economical and *moderateur;* its light is intense, yet as soft and as supportable as that of gas, while possessing more regularity and fixedness. Mr. Maxim's generating machine by the length of one horizontal ring, enables mixed illumination to be obtained, that is, to utilize the variety of the current for the incandescence and the other for the voltaic arc. The Weston generating machine also deserves praise for the excellent uniformity with which it generates electric currents for lighting purposes. At the Grand Opera the government instituted a series of experiments to test the several systems of illumination versus gas; the arrangements were incomplete, so the result is undecided. It was at two of these experimental representations that the Maxim lamp won so many honors.

PHILOSOPHY.

PRAYER FOR PHYSICAL HEALING.

BY S. H. TROWBRIDGE.

Was anything gained by praying for the restoration of President Garfield? Did not the disabilities resulting from the assassin's bullet, work out their results in accordance with the laws of nature, and are not these laws immutable? "Can a man take fire into his bosom, and his clothes not be burned?" "Can one go upon hot coals, and his feet not be burned?" Can one violate the laws of his being and not suffer the legitimate consequences of his acts? "Whatsoever a man soweth, that must he not also reap?"

God works by law in nature and in grace. He has ordained the laws of nature as his own plan of controlling the material universe. We are satisfied that he conforms strictly to these laws in all the physical phenomena which our minds have, as yet, been able fully to understand. To more and more of these do we find him thus to conform as science advances. Many events, which were once looked upon as miraculous, are now explained in this way to the satisfaction alike of friends and foes of the Bible. Some events recorded in Scripture that we are accustomed to consider genuine miracles, are accompanied in the record itself with a statement of the physical causes which are there distinctly said to have produced them. Elijah is said to have been carried up from the earth in a whirlwind. And travelers tell us that severe whirlwinds, capable of carrying up heavy bodies, often occur on the banks of the Jordan; caused by a severe gale as it sweeps over the abrupt bluffs. The waters of the Red Sea, as we are told in the Bible, were parted for the crossing of the Israelites by means of a "strong east wind" that blew "all that night." And if it is true, as surveyors of the Suez Canal route assert, that a bar or upheaved crest, a little beneath the water's surface, marked their line of march across the sea, the friction of a strong wind would be sufficient to blow the water away and leave dry land for the passage of the hosts of Israel.

Clay, which is known to possess healing properties, was used by Christ in opening the eyes of the blind man. I know that this and washing in the pool of Siloam are said to be only helps to his faith; but what harm is there in the supposition that Christ knew of the healing properties in the clay, and availed himself of them? Much has been said, of late, about "faith cures," and, in many cases, the proximate cause has been traced to the mere effect of the mind on the body, or to the "expectant attention" of the patient to some supposed effective remedy. And it is claimed that it makes no difference what the remedy is, or

however inefficacious in itself. A thermometer in the mouth of a patient has been mistaken for some wonderful means of restoration and has effected a complete cure. Have not bread pills often done the same? And is it not true that the mind has more influence over the body than medicine? There is abundant evidence to prove this. Yet, in all such cases of cure, there is the inscrutable connection of the mind with the body which is not known to conform to natural law, and doubtless can never be traced to its action. But the supposition is reasonable that they do conform to law, but in higher phases of it than we are now able to comprehend.

Miracles are, doubtless, as much in the order of nature as the germination of a seed or the budding of a flower, and these are miracles. Dr. Cocker has well said: "The devout feel that wherever God's hand is *there* is miracle, and it is simply an undevoutness which imagines that only where miracle is can there be the hand of God." Yet, it is well to observe the fact that the cure is due to some peculiar state of mind in the patient, does not at all *prove* that it is any *more* the result of natural law, or any *less* the influence of the Power superior to matter and its laws. The confessed fact that it is inscrutable to man gives sufficient latitude for the entrance of the power of Divine will, and makes this the most reasonable supposition.

Now *if* we should ever *fully know* that faith cures, and also the dreams and visions of patriarchs and prophets, or presentiments and the like, of devout people at the present day, were caused by some thoughts or images of waking moments, were they not brought about by Divine agency, and just as legitimately revelations from God as if not in the order of nature? And *if* men should ever learn, by closer and deeper study of God's laws and of his word, that some or all of Christ's physical works which we now call miracles were strictly conformable to nature's laws which we *can* understand, would not the works have accomplished their purpose just as effectually? Should we lower God to our level, or detract in the least from his greatness and his goodness? Should we not rather thus, by Divine help, raise ourselves toward God in his own appointed way? And God in Christ is the model of excellence toward which we should constantly struggle. This discovery would only bring the Christian and the scientist closer together in their belief. The design of the Creator in benefiting the creatures he has made and loves to bless, in answer to their prayers, and often without them, would be entirely satisfactory to the Christian; and if these were performed in the order of nature, the demands of science would be satisfied.

But the question now arises: How is this apparent subserving to law consistent with special providence and prayer? This is, doubtless, at present, the real battle-ground between the theistic and materialistic schools of thought. It may be answered briefly, that He who has established law as his plan of governing the universe is not a slave bound in chains of subjection to the creature of his own hand. But the objector urges that changes in nature, brought about in answer to prayer, would be "a violation of the order of nature," a "contradiction of natural laws;" and "no act of humiliation, individual or national can

XUM

effect this. Yet, this same objector, Mr. Tyndall, acknowledges, at another place and time, that "it is no departure from scientific method to place behind natural phenomena a universal Father, who in answer to the prayers of his children alters the current of phenomena." Again, we are told every effect must have a cause, and if the prayer of individuals could modify or change these causes, it would destroy the uniform workings of Nature's laws, and then they would cease to *be laws*. "The course of nature is deaf to prayer and entreaty."

Such objections are based upon a short-sighted view of the question. We have already admitted that uniformity is the order of nature and cheerfully add, in the language of another, that "the regular order of nature is the house we live in. It could not be disturbed by frequent miracles and be fit for the training of rational beings." It is never thus disturbed without a sufficient cause. And, if we seek a reason for such modification, we find it in the fact of man's free agency and sin. As sin, a supernatural cause, has produced derangement and deformity in nature, miracles, also supernatural, are needed to undo its evil consequences. As supernatural violations of the laws of health have brought disease upon the human body, the remedies of a physician, also supernatural, are essential to a restoration of the system to its normal operations under Nature's laws.

I have often seen an engineer start and stop his engine at irregular intervals, cause it to move rapidly or slowly, to continue in motion for a long or for a short time, to go backward or forward, at the will of another who was appointed to direct his movements; yet the engineer not once violated the law according to which the engine operated. One can do this who knows but little about the method of constructing the engine whose workings he modifies at will. And is it not strictly in harmony with the highest reason to suppose that He who formed, in minutest detail, the mechanism of nature, and upholds all things by the word of his power, can and does modify the movements of this complicated machinery at the confiding request of those whom he has commanded to pray and whose prayers he has promised to hear and answer? True, every event must have its cause, and this direct cause is the effect of some more remote cause, and so on, infinitely beyond the reach of human reason. The final, or first cause, of every phenomenon is God working through this long chain of cause and effect. Prayer effects a change at the first link, or staple, through God himself, and thus, a corresponding change through the entire chain; therefore all is in accordance with the laws of nature.

Man can *by his own acts* interfere with the harmonious workings of nature. He can cause rain by conflagration or cannonading or, more slowly, by the planting of trees. He can and does, by his interference with nature, modify the rigor of the climate and increase or diminish the fertility of the soil. He is constantly overpowering the force of gravitation. He can modify at will the chemical forces and also those of heat, light, and electricity. He can act in numberless ways on the chain of cause and effect from without, producing new results by new combinations of nature's laws; yet he does not destroy or render ineffective these laws. And not only can he induce disease or health in the animal system *by*

physical appliances, but he can do the same *without* these appliances, and can even destroy life by acts of his will without acting in any physical way upon his victim. And if the will of finite man can act upon nature in harmony with her laws, and the spirit of man can *directly* move for good or ill his fellow man without any known use of these laws, has not the infinite God equal power? There are higher laws than the physical by which mind acts on mind and spirit on spirit, and if *man* can move man thus without the incumbrance of physical laws, cannot God? Rev. E. P. Roe has beautifully said: "The throne of God seems a long way round to reach the friend at our side—for the mother to reach the child in her arms—but it usually proves the quickest and most effectual way."

"Is any sick among you? let him call for the elders of the church; and let them pray over him, annointing him with oil in the name of the Lord; and the prayer of faith shall save the sick, and the Lord shall raise him up." "The effectual, fervent prayer of the righteous man availeth much." "Elias was a man subject to like passions as we are, and he prayed earnestly that it might not rain; and it rained not on the earth by the space of three years and six months. And he prayed again, and the heavens gave rain, and the earth brought forth her fruit." These are declarations of infinite wisdom, from him who holds in his hand the last link in the long chain of nature which makes *tangible* communication between God and man, and of God the spirit who, we doubt not, can reach the spirit of man in a much more direct way.

True, prayers from thousands of Christian hearts went to heaven for the recovery of our murdered President; and yet he died. Does this disprove the efficacy of prayer? Nay, verily. May not Christ's reply to his disciples, when they asked why they could not heal the lunatic who was sore vexed with a devil, explain the matter? "Because of your little faith." If you had sufficient faith you might have removed this mountain of difficulty. "Howbeit this kind goeth not out but by prayer and fasting." Did the destruction of Sodom prove that Abraham's prayers for its preservation were of no avail? Were not his petitions granted just so long as his faith held out and he continued to offer them? Who shall say that if he had persevered till he had reduced the number of righteous necessary to save the city to one (Lot), God would not still have given him the city! Men in prayer are too much like the aged lady behind a runaway horse, who could trust in the Lord till the breeching broke, and then lost all expectation of help. So long as the good President and his noble wife, with the surgeons, held on to the bare "*chance*" of recovery, the people saw encouragement to pray; but when the last chance had vanished from the eyes of men, and the only hope was in God, might not then the faith that would have honored God alone, and that cometh by prayer and fasting, have prevailed and raised, as from the dead, him whom all the world now mourns?

XUM

RESPONSIBILITY OF THE INSANE.

In the January number of the *North American Review*, a quintet of physicians, who have the reputation of being especially intelligent upon the subject of insanity, discuss the question of its moral responsibility. The sum of their disquisitions impresses upon the reader the fact that the proper treatment of the matter by the courts is yet in an uncomfortably dense fog, and that the best that can be done, in the absence of definiteness, is to judge each case on its individual merits. All admit that society must protect itself, but there the unanimity seems to end, though the idea is substantially advanced that too many criminals escape upon untenable pleas of insanity. If the doctors can do no more for us than this, the difficulty of procuring intelligent statutes from legislators must be appreciated.

Dr. J. L. Elwell leads off in the discussion with a paper which is severe on the tendency to expand the insanity line of defense. He says that "there is no dispute as to the entire irresponsibility of those not knowing the difference between right and wrong," but there he would draw the line. This class, he claims, is a very limited one, and is rarely guilty of capital crimes. "On the other hand, the number of alleged insane thrown to the surface, as the emergency requires —for whom the defense of irresponsibility is so constantly interposed in courts of justice—probably constitute ninety-nine per cent of all the insane population." Evidently very few alleged insane murderers would escape if Dr. Elwell had his way. He claims that society has the same right to protect itself that an individual has. The object of courts is the protection of society. "They are not missionary bodies for the conversion of the vicious classes," and society needs more protection from the insane than from the sane. "It is said this is inhuman; but would it not be more inhuman and brutal to spare the criminal at the expense of society? To whom belongs the greater right to live, the assassin or society, any member of which is constantly exposed to death at his hands?" There have been so many refinements and amplifications of insanity of late, that specialists can prove almost any one insane. Dr. Elwell shows that if Garfield had killed Guiteau instead of Guiteau Garfield, the former could have presented a good defense, from the fact that it could be proved that he had been repeatedly superstitious about his death, and yet no more sane man lived than he. The writer does not dwell on the medical aspects of lunacy; he confines himself mainly to the defense of society, and closes thus: "This being the alarming state of the question we have tried to examine, is it not time that the mania for excusing crime on the ground of moral insanity be arrested, either by the medical profession, the courts, by the common consent of the people, or by all?"

Dr. George M. Beard approaches the subject in an entirely different spirit from that of Dr. Elwell. He calls a halt and criticises the angry mood that the people are now in, contending that if Guiteau had killed a bootblack instead of a president there would be no difficulty at all about his acquittal. He says: "If

there be such a disease as insanity, then Guiteau is and was insane, and has been for years, and the assassination of the President was not needed to make the diagnosis sure." He recites a number of cases which have come under his personal treatment to show parallel instances of undoubted insanity. The fact of Guiteau's moral irresponsibility being established in Dr. Beard's mind, he denies that society will be benefited by his hanging. He writes: "Thirty days we mourned for Garfield; we should mourn for years were we to hang his assassin, after having proof of his irresponsibility. We are more likely, as a nation, to give up our homes and live in wigwams than to judicially and uniformly shoot or hang the irresponsibly insane." He claims that the punishment of such persons by hanging would not deter other insane individuals from crime, but would invite and urge them to commit it. He supports his theory at length by illustrations of the effect of terrible examples on weak and deranged minds. "The sight or tidings of horrid crime or of horrid punishment, so acts on natures organized for insanity and tilted on its edge as to throw them completely over, and cause them to repeat the crime at the risk of punishment. Milder and less imposing procedures, that act less violently on the emotions—such as flogging or confinement in jail or asylum—have the deterring, without the attractive, force of punishment." We have not the time or space here to give to Dr. Beard's argument the attention it deserves, but its drift can be seen at once, and anything coming from his scientific and studious mind commands respect. He has nothing to urge against Guiteau's confinement for life.

Dr. Seguin enters at length upon the discussion of the different kinds of insanity. He is opposed to capital punishment on general principles, but otherwise is scarcely less severe in his strictures upon the release of criminals on the plea of insanity than Dr. Elwell. He believes "that the criminal insane should be held just as responsible to human punishment—*i. e.:* preventative and educating punishment—as sane criminals. Society must protect itself against crime more intelligently, yet more rigidly, than it now does." Dr. Jewell says that, while a knowledge of right and wrong may be accepted as the general standard by which to judge of the responsibility of the insane, there are occasions where irresistible impulse acts against that knowledge. He would therefore give the alleged insane person a little better opportunity for escape than the other authorities. He dwells upon the difficulty of determining doubtful cases, and suggests comparing the act committed with the probable conduct of sane persons under like temptations or motives. He also recommends the adoption of methods to raise the jurisprudence of insanity from its low conditions. He thinks this might be accomplished by associating competent medical men with the judge and jury in such cases.

Dr. Folsom discourses mainly upon the growth of mental disease and incontrollable impulses. The best he can do to help us out of the difficulty is to claim that there must be other evidences of insanity than the crime, that the whole group of symptoms must correspond to a definite disease; that crime must be a part of the natural history of the disease, and that a reasonable degree of self-con-

XUM

trol should be exercised according to the capacity for it in each case. Beyond that point, he says, is endless confusion if we hold men irresponsible. Men are responsible if they possess "mental capacity for ordinary reason, reflection and judgment, the knowledge of right and wrong as applied to the particular act, the power of self control within reasonable limits, the absence of insane delusions overpowering reason." With the exception of Dr. Beard's views, the general drift of the discussion tends toward holding Guiteau responsible.—*Globe-Dem.*

STATE ASSASSINS AND THE DEFENSE OF INSANITY.

BY JAMES W. CLARKE.

The tragedy of the 2nd of July, last, suddenly revived public interest in an old topic,—the defense of insanity in capital cases. It is a well-worn theme, much discussed, and always with an unsatisfactory result. What is moral insanity? What is legal insanity? Conclusive answers to both these questions have often been attempted, but never given with such definiteness and decisiveness as to shut off debate. Every day the controversy is resumed in our courts, and apparently will go on to the end of time. It is settled one day, and the day after we find it is not settled at all. "What," said the late Dr. Forbes Winslow, "is my test of insanity? I have none. I know of no unerring, infallible, and safe rule or standard applicable to all cases." So, too, the British judges, whose effort to define the undefinable we shall presently examine at length, after all their elaboration of statement touching what does and what does not constitute legal insanity, finally confessed that "the facts of each particular case must of necessity present themselves with endless diversity, and with every shade of difference in each case." But if it be difficult to define what is legal insanity, which is a mere matter of human law, how much more difficult is it to determine and define what is moral insanity? Dr. Sam Johnson declares that "all power of fancy over reason is a degree of insanity," and Montaigne asserts that between genius and madness there is but "a half turn of the toe." M. Taine concurs in this dictum, and philosophically avers that "insanity is not a distinct and separate empire; our ordinary life borders upon it, and we cross the frontier in some part of our nature."

It has been the periodic mission of the assassin to revive this moot question. One day the world stands and shudders with an unanimous horror, and the next divides upon the old issue,—Was he insane? It is oppressively monotonous, in looking back over these historical tragedies, to find how invariably the modern imitator of Brutus comes down to the foot-lights with a pistol in one hand and a plea of insanity in the other. In American history, so far, we have had only two creatures corresponding to what, in the vocabulary of Europe, would be called regicides. In the first case there was no opportunity offered to the assassin to plead insanity. A vast amount of legal lore and medical metaphysics was fore-

stalled by the summary shooting of Wilkes Booth in the barn where he was brought to bay.

It is, perhaps, worthy of note that not one of the men who have of late murdered or attempted to murder, czars or emperors, has offered the plea of insanity. In Great Britain and the United States it seems to be the assassin's invariable defense. And in both countries counsel for the accused start with the advantage of being able to ask the jury, as Mr. Cockburn did in the cases both of Pate and McNaughten,—Could they believe that any sane man could have committed such an act? And that is the question which the tragic event that has recently shocked and saddened both hemispheres once more invests with melancholy importance and presents for decision to an American jury.—*December Atlantic.*

GEOGRAPHY.

THE JEANNETTE—PROBABILITIES.

BY P. A. TOWNE.

It is very likely that the reader has occasionally stumbled upon the remark that "history is constantly repeating itself." Whether true or not, it is often a very convenient mode of introducing what one wishes to say. No one can have followed the reports of the several expeditions sent out in search of the Jeannette during the past summer without having been painfully reminded of similar reports from expeditions in search of Sir John Franklin after his last and fatal voyage in Arctic exploration. It is to be hoped that the parallel between the two histories will stop with the events of 1881. Let us see if the probabilities are not in favor of the belief that such a wish will be realized.

Lieut. DeLong was last seen in September, 1879, steering toward Wrangel Land. During the past summer Wrangel Land has been visited twice, and Lieut. Berry has not only circumnavigated it but has skirted the impenetrable ice some sixty miles, or one degree, north of it. He saw no land between it and the North Pole. Wrangel Land is at about 72° north latitude, and its distance from the Pole is therefore about 1,260 miles. In July, 1827, Capt. Parry went in an ice-boat to a point on the ice 82½° north latitude. This point is north of Spitzbergen. The three points, Wrangel Land, the Pole, and Spitzbergen are in almost a straight line, with the Pole between the two extremes. The land lying nearest the North Pole, which has been seen, is called Petermann Land, and is in latitude about 84° north of Greenland. If Petermann Land is not a myth it is only about 420 miles from the Pole. Cape Joseph Henry is in its neighborhood, and is in about latitude 83° north. The point of the Eastern Continent

nearest the Pole is Cape Tcheliouskin, which is in latitude 77½° north, or about 840 miles from the Pole. Franz Joseph Land to the east of Spitzbergen is in latitude 82° north, and Nova Zembla is in latitude 97° north. Herald Island, to the east of Wrangel Land, is in latitude 72½° north.

From these data it is seen that the centre of the unexplored region of the Arctic Ocean is not the North Pole, but a point about 84° north latitude, between the Pole and Wrangel Land.

The reports of the past summer teach us, if they teach anything at all, that in September, 1879, Lieut. DeLong may have found an opening in the ice north of Wrangel Land. He was last seen steaming onward in an apparently open sea. He was engaged in by far the most fascinating exploring expedition now possible to navigators. His instructions were to go to the North Pole, if possible.

If he found his way clear he did not spend even twenty four hours in considering the question of stopping at Herald Island or Wrangel Land. He went through the opening without hesitation, trusting the rest to his good luck. He was near Wrangel Land in the most favorable month of the year. If the sea was open he could reach the goal of his ambition in as few as eight or ten days from the time he was last seen. But once on the north side of the ice barrier he was there not only for a few months, but, it may be, for years. He found the sun in the southern horizon, and a few days later the long night of five or six months shut him out of the possibility of retreat by way of his entrance into the polar basin. Ice formed quickly around his little ship. If he found an island he landed upon it, fixed up his winter quarters, and waited for the appearance of the sun in 1881.

In 1827 Capt. Parry found himself on ice moving south faster than he could draw his boats upon it toward the north, and not only so, but the ice was thinning so rapidly as to compel his retreat toward Spitzbergen. This fact seems to indicate that the current of the Arctic Ocean, at least in some years, moves across the Pole from the direction of Wrangel Land toward Spitzbergen, and that it is, therefore, entirely within the limits of probability that DeLong may emerge from the Arctic basin by way of Spitzbergen in 1882. He was provisioned for three years, and he had, therefore, no reason not to take the greatest possible advantage of his presence in this new and wonderful field of discovery. There was no need of hurrying back to a more comfortable climate, even though his exit from the Polar seas has been possible during the past summer.

But whether the unexplored part of the Arctic Ocean be entirely free of land, or whether it be an archipelago, there is no point in its circumference at which DeLong may not make his appearance in 1882. His most likely point of exit is Spitzbergen, but his final success in efforts to reach civilization once more must depend upon his skill as a navigator in the midst of vast floating fields of ice. He must go wherever the ice carries him. The only alternative which an examination of the most recent maps of the Arctic regions suggests is, that DeLong and his ship went to the bottom in the autumn of 1879. We are not ready to believe this to be the case, nor are we ready to conclude from the present condi-

tion of the history of his expedition that "the North Pole is inaccessible." It is evidently the purpose of Lieut. Berry to follow DeLong in 1882 if he can, and we hope he will find no obstacle to so doing. We do not believe there is any use in hunting along the coast of North America. He did not go in that direction. He went toward the North Pole, and in that direction he must be looked for. He must be followed if he is found. If no one has the courage to do that, then let us wait till the Jeannette appears.—*The Sentry.*

EXPLORATIONS BY USE OF BALLOONS.

Commander Cheyne of the English Navy, is in New York, endeavoring to raise $80,000 to equip an Anglo-American Expedition to find the North Pole. This English naval officer has participated in three polar expeditions, and is an experienced navigator in northern latitudes. He proposes a novel plan to reach his objective point: His intention is to go to the highest latitude attainable by vessel, then take to dog-sleds, and when the mythical "open sea" is reached, he proposes to employ balloons to make the rest of the journey. Lieutenant Schwatka, of our army, who is a recent Arctic celebrity, approves of Commander Cheyne's method, and will accompany him on his expedition if he be successful in obtaining the funds to fit it out.

Mr. Grinnell, son of the merchant-prince, of New York, who contributed so liberally to the search for Sir John Franklin, is said to be ready to aid Commander Cheyne to any reasonable extent necessary, and the exploring vessel is to be named "The Grinnell."

ASTRONOMY.

ASTRONOMICAL NOTES FOR JANUARY, 1882.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.	Declination S.	Equation of Time.
1st.	18h. 49m.	22° 58′	3m. 59s.
15th.	19 50	21 04	9 48
31st.	20 57	17 15	13 45

THE MOON.

Date.	Right Ascension.	Declination N.	Semi-diameter.
1st.	4h. 50m.	22° 01′	12′ 15″
5th.	8 15	15 29	14 49
10th.	12 00	5 11 S.	14 54
15th.	16 15	21 29	15 57
20th.	21 21	10 22	16 42
25th.	1 55	14 56 N.	15 48
31st.	7 13	19 13	14 52

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage.
1st.	18h. 37m.	24° 46′	11h. 52m. A. M.
15th.	20 16	21 55	0 36 P. M.
31st.	21 57	13 26	1 17

Semi-diameter on the 1st, 2.3″; on the 31st; 3.0″.

VENUS.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Transit.
1st.	17h. 56m.	23° 22′	11h. 11m. A. M.
10th.	18 51	23 16	11 26
20th.	19 45	21 57	11 41
31st.	20 43	19 15	11 56

Semi-diameter on the 1st, 5.2″; on the 31st, 5.0″.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	6h. 16m.	27° 03′	11h. 34m. P. M.
10th.	6 01	27 10	10 39
20th.	5 51	27 06	9 49
31st.	5 46	26 55	9 01 P. M.

Semi-diameter on the 1st, 8.2″; on the 31st, 6.6″.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	2h. 57m.	15° 44′	8h. 14m. P. M.
10th.	2 57	15 45	7 34
20th.	2 57	15 50	6 55
31st.	2 59	16 04	6 14

Semi-diameter on the 1st, 21.5″; on the 31st, 19.5″. On the 10th at 3h A. M. it will be stationary in right ascension.

JUPITER'S SATELLITES.

Abbreviations used: In. denotes ingress; Eg., egress; Dis., disappearance; Re., reappearance; Ec., eclipse; Oc., occultation; Tr., transit of satellite; Sh., transit of shadow. K. C. M. S. T. to be used in observations.

DATE.	PHENOMENA.		
3rd,	10:13 p. m.	Ganymede,	Oc. Dis.
4th,	10:28 p. m.	Io,	Oc. Dis.
5th,	7:40 p. m.	Io,	Tr. In.
	8:50 p. m.	Io,	Sh. In.
	8:55 p. m.	Europa,	Sh. In.
	9:19 p. m.	Europa,	Tr. Eg.
	9:53 p. m.	Io,	Tr. Eg.
	11:02 p. m.	Io,	Sh. Eg.
6th,	8:15 p. m.	Io,	Ec. Re.
7th,	6:06 p. m.	Europa,	Ec. Re.
	6:50 p. m.	Ganymede,	Sh. Eg.
12th,	9:09 p. m.	Europa,	Tr. In.
	9:32 p. m.	Io,	Tr. In.
13th,	6:47 p. m.	Io,	Oc. Dis.
	10:11 p. m.	Io,	Ec. Re.
14th,	6:13 p. m.	Io,	Tr. Eg.
	7:26 p. m.	Io,	Sh. Eg.
	8:42 p. m.	Europa,	Ec. Re.
	8:59 p. m.	Ganymede,	Sh. In.

DATE.	PHENOMENA.		
14th,	10:51 p. m.	Ganymede,	Sh. Eg.
20th,	8:40 p. m.	Io,	Oc. Dis.
21st,	6:10 p. m.	Europa,	Oc. Dis.
	7:10 p. m.	Io,	Sh. In.
	7:43 p. m.	Ganymede,	Tr. In.
	8:05 p. m.	Io,	Tr. Eg.
	9:22 p. m.	Io,	Sh. Eg.
22nd,	6:36 p. m.	Europa,	Ec. Re.
23rd,	6:10 p. m.	Europa,	Sh. Eg.
28th,	7:44 p. m.	Io,	Tr. In.
	9:05 p. m.	Io,	Sh. In.
	9:57 p. m.	Io,	Tr. Eg.
	11:17 p. m.	Io,	Sh. Eg.
	11:36 p. m.	Ganymede,	Tr. In.
29th,	8:32 p. m.	Io,	Ec. Re.
30th,	6:11 p. m.	Europa,	Sh. In.
	6:12 p. m.	Europa,	Tr. Eg.
	8:49 p. m.	Europa,	Sh. Eg.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 16m.	11° 3′	7h. 34m. P. M.
10th.	2 16	11 5	6 54
20th.	2 17	11 11	6 16
31st.	2 18	11 22	5 34

SATELLITES.

Kansas City Mean Time of the first elongation visible, East and West.

	DATE.		DATE.
Mimas.	4th, 9:20 P. M., East.		On the 12th, 9:38 P. M., West.
Encelahns.	1st, 1:14 A. M., East.		Not visible.
Tethys.	14th, 7:14 P. M., East.		Not visible.
Dione.	7th, 8:16 P. M., East.		Not visible.
Rhea.	6th, 1:16 A. M., East.		Not visible.
Titan.	Not visible.		On the 8th, 5:44 A. M., West.
Hyperion.	2nd, 9:32 P. M., East.		On the 8th, 5:20 A. M., West.
Japetus.	11:00 P. M., East.		

The time of other elongations may be found by adding or subtracting the following periods:

Mimas.	0d. 22.6h.	Rhea.	4d. 12.5h.
Enceladus.	1 8.9	Titan.	15 23.3
Tethys.	1 21.3	Hyperion.	21 7.8
Dione.	2 17.7	Japetus.	79 22.0

XUM

APPARENT ELEMENTS OF THE RING.

Outer Major Axis 41.4″, Minor Axis 12.9″.

Inclination of northern Semi-Minor Axis to circle of declination from North to East, 16.8′.

Elevation of the earth above the plane of the Ring, 18° 13.1′; of the Sun, 20° 10.9′.

Earth's longitude from Saturn counted on plane of ring from the Ring's ascending node on Equator, 87° 45.7′; Ecliptic 45° 01.6′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	11h. 19m.	5° 16′	4h. 35m. A. M.
31st.	11 17	5 32	2 31

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	2h. 48m.	14° 18′	8h. 05m. P. M.
31st.	2 47	14 17	6 03

GALILEO AND CURRENT MYTHS.

At the St. Louis University, November 15th, Rev. H. Calmer, S. J., took up another controverted point of history and discussed it before the post-graduates. The lecture was on Galileo, and another on the same subject will be delivered by the Reverend Father. He began with Von Gebler's statement:

As we study Galileo's connection with the Inquisition critically, we must do way with "the current myths." Then he continued: We might have supposed that after M. de l'Epinois, in 1867, published from the celebrated Vatican MSS. the entire process of his trial and nominal imprisonment, these myths would have ceased circulating. The blinding of Galileo is a creation of the lively popular mind. The fable may have taken rise from the subsequent loss of his sight. The assumed exclamation "*E pur si muove*" is legendary. No modern historian of note gives it any credit. Nor did he recant, clad in the "hair shirt." The official document, although it goes very much into detail as to the way in which the oath was performed, says nothing of the shirt, and neither should authors have said anything about it.

Moreover, one glance at the truest historical resource for the famous trial—the official dispatches of Niccolini to Cioli—would convince any one that Galileo spent altogether only twenty-two days, not in a prison cell with grated windows, but in the handsome and commodious apartment of an official of the Inquisition. Was he tortured by the Inquisition? "Those who undertake to accuse the Inquisition on this point are forced to have recourse to fiction," says Von Reumont, and with him agree Lord Brougham, Biot, Von Gebler, and other authors worthy of trust. The expression, "examen rigorosum," found in the decree, proves a

most a "territio verbalis." Consult on this the Letters of Galileo, Limborch's "Historia Inquisitionis," and the Vatican MSS. Nor were the latter tampered with or withdrawn. "Galileo was not a martyr of science," says Henry Martin. Finally, nor was Galileo "forced to ask pardon of God by a retrograde clergy, for having revealed the eternal and ravishing harmonies by which he rules the universe." To the pontiffs and dignitaries of Rome we are mainly indebted for the Copernican system. Galileo was not the first to broach it. Cardinal Nicholas de Cusa promulgated it before Copernicus. The system was taught in the Jesuit University in Rome. Another Jesuit explained it at Sapienza, the Pope's own University. As long as it was treated as a scientific and not a religious question, the church put no hindrance in the way. Galileo was no exception. Gardens and palaces were flung open for his use, and prelates and cardinals were his admiring attendants. Whence, then, the change in 1616?—*Globe Democrat.*

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

RAIN-FALL, AT WASHBURN COLLEGE, BY MONTHS, FOR THE LAST THREE YEARS.

MONTHS.	1879	1880	1881
January	1.20	No record.	0.60
February	0.34	0.68	2.600
March	0.15	1.76	1.34
April	3.872	1.404	1.085
May	3.55	3.588	3.81
June	5.901	5.835	5.84
July	3.923	3.09	0.85
August	0.519	9.11	0.72
September	1.852	2.42	2.74
October	2.457	3.08	4.65
November	7.218	1.76	1.70
December	2.154	0.35	0.40
Total	33.136	32.777	26.335

Highest barometer during month 29.48, on the 23rd. Lowest barometer during month 28.71, on the 29th.

Highest temperature during month 63, on the 29th. Lowest temperature during month 6, on the 24th.

The usual summary by decades is given below.

Temperature of the Air.	Nov. 20th to Dec. 1st.	Dec. 1st to 10th.	Dec. 10th to 20th.	Mean.
Min. and Max. Averages.				
Min	23.0	26.2	29 2	26.1
Max	47.3	45.5	49.8	47.5
Min. and Max	35.1	35 8	39.0	36.6
Range	24.3	19.3	19.6	21.1
Tri-Daily Observations.				
7 a. m.	30.4	31.2	35.7	32.4
2 p. m.	41.7	44.6	47.7	44.7
9 p. m.	33.4	37.1	40.7	37.1
Mean	34.8	37.6	42.3	34.9
Relative Humidity.				
7. a. m.	.80	.79	.80	.80
2 p. m.	.62	.62	.70	.65
9 p. m.	.69	.72	.85	.75
Mean	.70	.73	.78	.74
Pressure as Observed.				
7 a. m.	29.07	29.12	29 08	29.09
2 p. m.	29.14	29.06	28.02	29.07
9 p. m.	29.09	29.09	29 04	29.07
Mean	29 08	29.09	28.05	29.07
Miles per Hour of Wind.				
7 a. m.	12.6	10.3	10.8	11.2
2 p. m.	18.3	16.2	15.5	16.7
9 p. m.	11.9	14 0	14.0	13.3
Total miles	3806	3311	3630	10747
Clouding by Tenths.				
7 a. m.	4.6	5.3	6.7	5.5
2 p. m.	3.1	7.8	7.7	6.2
9 p. m.	3.0	6.6	6.4	5.3
Rain.				
Inches	——	——	.40	.40

PRECIPITATION AND THE STORM-CENTRE.

BY S. A. MAXWELL, MORRISON, ILL.

In a former article to the Review, I attempted to show the relative positions of the storm-centre and the locality of tornadoes. In the ten instances of tornadoes there cited, all occurring in 1878, every one was found to be developed on the equatorial, or right-hand side of the path of minimum pressure. My investigations at that time led me to believe that other storms, besides tornadoes, had similar relations to the storm-centre.

Inasmuch as winds almost invariably blow toward the storm-centre, and the warm winds are the generators of rain, I came to the conclusion that the localities of greatest rain-fall would be found to the south of the track of "low." I constructed the following table to prove the truth of this conclusion. The table, made out from the Signal Service Weather Map for August, 1878, shows the

localities in the United States where rain-falls of more than three inches occurred, with the several dates, also the direction and approximate distance of "low" from the locality of the storm;

STATION.	RAIN-FALL, INCHES.	DATE.	DIR. OF ST'M-CENTRE DUR-ING STORM.	DISTANCE OF SAME.
Flushing, N. Y.	3.65	1st.	N. NW.	500
Ft. Barrancas, Fla	3.75	3rd.	N. NW.	1000
Colebrook, Conn.	6.67	4th.	W.	600
Newark, N. J	3 04	6th.	N.	400
Boston, Mass.	4.04	8th.	NW.	700
Charleston, S. C	7 71	13th.	S.	800
Mt. Sterling, Ill	4.00	17th.	W. NW.	400
Mt. Desert, Me.	3.15	17th.	NW.	400
Wood's Holl, Mass	5.11	18th.	NE.	400
Elmira, Ill.	3.29	19th.	W. NW.	150
Springfield, Mo.	3.30	21st.	NW.	400
Green Springs, Ala.	3.10	29th.	W.	200
Ft. Barrancas, Fla	9.75	30th.	SW.	400
Spring Garden, Tenn	4.70	30th.	N.	1000

The table gives fourteen storms, while the Signal Officer's report for the month names seven additional ones; but these not belonging to "charted storms" could not be included in the table. Of these fourteen, eight occurred on the right-hand side of the line of low pressure, and three of the remaining six, on account of the extraordinary direction taken by "low," took place on the left side of it. These three were the storms at Mt. Sterling and Elmira, Ill., and at Springfield, Mo., accompanying the storm-centre which passed over central Iowa on the 18th and on the 19th changed its course to the south, then to the west, and was last reported from southern Nebraska on the 20th. These three storms, though occurring to the left of the line of low pressure, were in localities where southerly winds prevailed, and hence were the results of precisely the same causes that produced the eight storms belonging to the other half of the storm-area. Of the remaining three storms, one occurred at Green Springs, Ala., on the 29th, and another the next day at Ft. Barrancas, Fla. They both belonged to a storm-area which also took an unusual course, viz: from north to south. Since "low" passed through the State of Mississippi the localities named were on the left side of the track; but in these instances the excessive precipitation was due to the mingling of the saturated surface winds from the Gulf with the cooler air of a higher stratum, as it ascended in the vicinity of the storm-centre.

The storm at Charleston on the 13th, may not have belonged to the storm-area whose centre was 800 miles to the south, but to another whose centre was 1,000 miles to the northwest. I think it more probable that it belonged to the latter, from the fact that the effects of the passage of "low" are felt much farther on land than on the sea. This latter fact is easily accounted for; since the sea absorbs the solar heat, while the land surface parts with it readily by radiation, thus

APPARENT ELEMENTS OF THE RING.

Outer Major Axis 41.4″, Minor Axis 12.9″.

Inclination of northern Semi-Minor Axis to circle of declination from North to East, 16.8′.

Elevation of the earth above the plane of the Ring, 18° 13.1′; of the Sun, 20° 10.9′.

Earth's longitude from Saturn counted on plane of ring from the Ring's ascending node on Equator, 87° 45.7′; Ecliptic 45° 01.6′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	11h. 19m.	5° 16′	4h. 35m. A. M.
31st.	11 17	5 32	2 31

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Transit.
1st.	2h. 48m.	14° 18′	8h. 05m. P. M.
31st.	2 47	14 17	6 03

GALILEO AND CURRENT MYTHS.

At the St. Louis University, November 15th, Rev. H. Calmer, S. J., took up another controverted point of history and discussed it before the post-graduates. The lecture was on Galileo, and another on the same subject will be delivered by the Reverend Father. He began with Von Gebler's statement:

As we study Galileo's connection with the Inquisition critically, we must do way with "the current myths." Then he continued: We might have supposed that after M. de l'Epinois, in 1867, published from the celebrated Vatican MSS. the entire process of his trial and nominal imprisonment, these myths would have ceased circulating. The blinding of Galileo is a creation of the lively popular mind. The fable may have taken rise from the subsequent loss of his sight. The assumed exclamation "*E pur si muove*" is legendary. No modern historian of note gives it any credit. Nor did he recant, clad in the "hair shirt." The official document, although it goes very much into detail as to the way in which the oath was performed, says nothing of the shirt, and neither should authors have said anything about it.

Moreover, one glance at the truest historical resource for the famous trial—the official dispatches of Niccolini to Cioli—would convince any one that Galileo spent altogether only twenty-two days, not in a prison cell with grated windows, but in the handsome and commodious apartment of an official of the Inquisition. Was he tortured by the Inquisition? "Those who undertake to accuse the Inquisition on this point are forced to have recourse to fiction," says Von Reumont, and with him agree Lord Brougham, Biot, Von Gebler, and other authors worthy of trust. The expression, "examen rigorosum," found in the decree, proves a

most a "territio verbalis." Consult on this the Letters of Galileo, Limborch's "Historia Inquisitionis," and the Vatican MSS. Nor were the latter tampered with or withdrawn. "Galileo was not a martyr of science," says Henry Martin. Finally, nor was Galileo "forced to ask pardon of God by a retrograde clergy, for having revealed the eternal and ravishing harmonies by which he rules the universe." To the pontiffs and dignitaries of Rome we are mainly indebted for the Copernican system. Galileo was not the first to broach it. Cardinal Nicholas de Cusa promulgated it before Copernicus. The system was taught in the Jesuit University in Rome. Another Jesuit explained it at Sapienza, the Pope's own University. As long as it was treated as a scientific and not a religious question, the church put no hindrance in the way. Galileo was no exception. Gardens and palaces were flung open for his use, and prelates and cardinals were his admiring attendants. Whence, then, the change in 1616?—*Globe Democrat.*

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

RAIN-FALL, AT WASHBURN COLLEGE, BY MONTHS, FOR THE LAST THREE YEARS.

MONTHS.	1879	1880	1881
January	1.20	No record.	0.60
February	0.34	0.68	2.600
March	0.15	1.76	1.34
April	3.872	1.404	1.085
May	3.55	3.588	3.81
June	5.901	5.835	5.84
July	3.923	3.09	0.85
August	0.519	9.11	0.72
September	1.852	2.42	2.74
October	2.457	3.08	4.65
November	7.218	1.76	1.70
December	2.154	0.35	0.40
Total	33.136	32.777	26.335

Highest barometer during month 29.48, on the 23rd. Lowest barometer during month 28.71, on the 29th.

Highest temperature during month 63, on the 29th. Lowest temperature during month 6, on the 24th.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Nov. 20th to Dec. 1st.	Dec. 1st to 10th.	Dec. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min.	23.0	26.2	29 2	26.1
Max	47.3	45.5	49.8	47.5
Min. and Max	35.1	35 8	39.0	36.6
Range	24.3	19.3	19.6	21.1
TRI-DAILY OBSERVATIONS.				
7 a. m.	30.4	31.2	35.7	32.4
2 p. m.	41.7	44.6	47.7	44.7
9 p. m.	33.4	37.1	40.7	37.1
Mean	34.8	37.6	42.3	34.9
RELATIVE HUMIDITY.				
7. a. m.	.80	.79	.80	.80
2 p. m.	.62	.62	.70	.65
9 p. m.	.69	.72	.85	.75
Mean	.70	.73	.78	.74
PRESSURE AS OBSERVED.				
7 a. m.	29.07	29.12	29 08	29.09
2 p. m.	29.14	29.06	28.02	29.07
9 p. m.	29.09	29.09	29.04	29.07
Mean	29.08	29.09	28.05	29.07
MILES PER HOUR OF WIND.				
7 a. m.	12.6	10.3	10.8	11.2
2 p. m.	18.3	16.2	15.5	16.7
9 p. m.	11.9	14.0	14.0	13.3
Total miles	3806	3311	3630	10747
CLOUDING BY TENTHS.				
7 a. m.	4.6	5.3	6.7	5.5
2 p. m.	3.1	7.8	7.7	6.2
9 p. m.	3.0	6.6	6.4	5.3
RAIN.				
Inches	—	—	.40	.40

PRECIPITATION AND THE STORM-CENTRE.

BY S. A. MAXWELL, MORRISON, ILL.

In a former article to the REVIEW, I attempted to show the relative positions of the storm-centre and the locality of tornadoes. In the ten instances of tornadoes there cited, all occurring in 1878, every one was found to be developed on the equatorial, or right-hand side of the path of minimum pressure. My investigations at that time led me to believe that other storms, besides tornadoes, had similar relations to the storm-centre.

Inasmuch as winds almost invariably blow toward the storm-centre, and the warm winds are the generators of rain, I came to the conclusion that the localities of greatest rain-fall would be found to the south of the track of "low." I constructed the following table to prove the truth of this conclusion. The table, made out from the Signal Service Weather Map for August, 1878, shows the

localities in the United States where rain-falls of more than three inches occurred, with the several dates, also the direction and approximate distance of "low" from the locality of the storm:

STATION.	RAIN-FALL, INCHES.	DATE.	DIR. OF ST'M-CENTRE DURING STORM.	DISTANCE OF SAME.
Flushing, N. Y.	3.65	1st.	N. NW.	500
Ft. Barrancas, Fla	3.75	3rd.	N. NW.	1000
Colebrook, Conn.	6.67	4th.	W.	600
Newark, N. J	3 04	6th.	N.	400
Boston, Mass.	4.04	8th.	NW.	700
Charleston, S. C	7 71	13th.	S.	800
Mt. Sterling, Ill	4.00	17th.	W. NW.	400
Mt. Desert, Me.	3.15	17th.	NW.	400
Wood's Holl, Mass	5.11	18th.	NE.	400
Elmira, Ill.	3.29	19th.	W. NW.	150
Springfield, Mo.	3.30	21st.	NW.	400
Green Springs, Ala	3.10	29th.	W.	200
Ft. Barrancas, Fla	9.75	30th.	SW.	400
Spring Garden, Tenn	4.70	30th.	N.	1000

The table gives fourteen storms, while the Signal Officer's report for the month names seven additional ones; but these not belonging to "charted storms" could not be included in the table. Of these fourteen, eight occurred on the right-hand side of the line of low pressure, and three of the remaining six, on account of the extraordinary direction taken by "low," took place on the left side of it. These three were the storms at Mt. Sterling and Elmira, Ill., and at Springfield, Mo., accompanying the storm-centre which passed over central Iowa on the 18th and on the 19th changed its course to the south, then to the west, and was last reported from southern Nebraska on the 20th. These three storms, though occurring to the left of the line of low pressure, were in localities where southerly winds prevailed, and hence were the results of precisely the same causes that produced the eight storms belonging to the other half of the storm-area. Of the remaining three storms, one occurred at Green Springs, Ala., on the 29th, and another the next day at Ft. Barrancas, Fla. They both belonged to a storm-area which also took an unusual course, viz: from north to south. Since "low" passed through the State of Mississippi the localities named were on the left side of the track; but in these instances the excessive precipitation was due to the mingling of the saturated surface winds from the Gulf with the cooler air of a higher stratum, as it ascended in the vicinity of the storm-centre.

The storm at Charleston on the 13th, may not have belonged to the storm-area whose centre was 800 miles to the south, but to another whose centre was 1,000 miles to the northwest. I think it more probable that it belonged to the latter, from the fact that the effects of the passage of "low" are felt much farther on land than on the sea. This latter fact is easily accounted for; since the sea absorbs the solar heat, while the land surface parts with it readily by radiation, thus

forming ascending currents of greater power than those produced over the surface of the ocean.

Thus it will be seen that while no doubt exists as to the eight storms occurring on the right of the line of low pressure, those on the left were the result mainly of accidental, and even extraordinary, conditions. Upon examining the weather-maps of other months I find still more convincing proofs that the great majority of heavy rain-falls occur in the right half of the storm-area; and of these the larger number are somewhat in advance of the storm-centre.

When the people learn to study the weather by means of the weather map and by their own observations, and place no reliance on the foolish generalizations of false prophets, they will then get possession of practical scientific facts of great value. If these facts were properly understood by the farmers of our country, it might result in the saving to them of millions of dollars annually.

November 19th, 1881.

THE METEOROLOGICAL CONDITIONS OF CHRISTMAS WEEK FOR THE PAST NINE YEARS.

BY P. F. LYONS, SIGNAL CORPS, U. S. A.

[*Taken from the United States Signal Service Records, at Leavenworth, Kansas.*]

The old adage "Green Christmas, open Winter," etc., etc., has been so closely allied to if not really a household expression, that we are prompted to give a review of the state of the weather as observed in this immediate vicinity during the winters of the past nine years. The principal point aimed at, however, although not strictly scientific, is to show the degree of credulity that may be attached to the adage "Green or warm Christmas without snow presages an open winter," and the converse, *vice versa*.

The Records are as follows: December 23rd, 1871, shows a snow-fall of six inches on that day, which was preceded and succeeded by a reasonably cold spell and hence a "White Christmas" followed by a fair average winter. December 19th, 1872, a snow-fall of six inches was had; it was the forerunner of a severe cold spell, which lasted for some time. A decidedly "White Christmas" was that, and the immediate winter fully up to the average, exceeding the former one in severity.

The third annual cycle is shown by our records to be a repetition of December 23rd, 1871, as to snow; but the amount was very small and it rapidly disappeared before the close of the following day: that Christmas was "green" and the old adage, "moderate winter" resulted. December 21st, 1874, a snow-fall of eight inches, followed by a moderately cold spell—snow mostly disappeared by Christmas; some severe cold snaps were had that winter, and the advocates of

of the old saying had to call it a "draw" that season, for the day was really a rather complex one, or a mean between the "white and green."

The character of the next Christmas was undoubtedly "green" and the succeeding winter decidedly open. The same day one year later, 1876, was literally "white," as snow fell both on the eve and day of the gladsome festival. A temperature prevailed during December and January of that season that was decidedly winterish and at times frigorific. The next annual cycle brought a return of a "Green Christmas," and there ensued a remarkably open winter, the lowest temperature observed that solstice was 6° being on January 6th.

In 1878 the winter began early in December, of that year, and continued to increase in severity, and on the 2d of January, following, the minimum fell to 12° below zero, and for the subsequent five days ranged at from 7° to—12.5°. With the exception of the 15th, the temperature remained continually below the freezing point from the 13th of December, at which time a snow-fall of eighteen inches occurred, until the 20th of the following month. We need hardly add that the Christmas of 1878 was decidedly a "white one" and the accruing winter long and severe. The recurrence of the next Christian festival showed a light-tint of snow, which fell on the 23rd, and was followed by a sharp, but short, cold spell that lasted until the 25th: that was all the winter-weather had for that season, and the Christmas, though not absolutely "white," was, certainly, not one conducive to verdure, for the minimum recorded—8°, on the eve of the day. The weather attending the Christmas of 1880, is too fresh in the minds of our readers to need details, further than to simply remark that while the preceding day was not as cold as those of the former one, it wasn't green, "not at all," for the temperature stood almost without exception at, and at times, considerably below 32°, from early in December until the near approach of the vernal equinox.

It would be almost superfluous to say that the Christmas just passed has been the "greenest" known to the oldest inhabitants, for such it really has been. By a comparison of the foregoing it will be seen that there has been a remarkable coincidence in the succession of open weather after a "Green Christmas:" whether the present winter will be anomalous or not remains for the future to determine. With the present meagre meteorological data, we could not venture to say what the outcome will be, for such would be mere conjecture or guess-work, and consequently not within the domain of science.

ON THE TIMBER LINE OF HIGH MOUNTAINS.

BY THOS. MEEHAN.

Mr. Meehan remarked that on the tops of most high mountains we find a total absence of ligneous plants. The highest alpine vegetation consists for the most part of acaulescent perennials. Lower down we may find some woody species, and often we come to dwarfed forms of trees of species, which, still

lower down, form forests of considerable height, and which, as timber trees, make what is known to mountain travelers as the "Timber Line." Thus in the mountains of Colorado, the forests commence at about 7,000 feet above the sea level, and continue up to about 11,000 feet, where they suddenly cease, and form at that elevation what is there shown as the "Timber Line." On Gray's Peak he found *Pinus aristata*, *Pinus flexilis*, *Abies concolor*, and *Abies Engelmannii*, with some willows, forming the timber line. The Coniferous trees were probably thirty or forty feet high, and it was interesting to note that this tall timber as suddenly ceased, as if a wood had been cut half a way by a woodman's axe. But at once commencing where the tall timber ceased, the same species exist as dwarf, stunted shrubs seldom exceeding three or four feet in height, and often but a foot, though trailing widely over the ground. In this stunted condition the species would often extend some fifteen hundred feet higher up, or half way from the recognized timber line to the top of the mountain. Other observers have noted that the average of 11,000 feet marks the entire timber line of the Rocky Mountain range.

So far as he knew, this peculiar timber line has been referred wholly to climatic conditions, of which temperature and moisture have been regarded as the chief elements in producing the results. That admirable botanist and energetic collector, Dr. C. C. Parry, in a paper on the Rocky Mountain alpine region, published in the "Proceedings of the American Association for the Advancement of Science" for 1869, p. 249, remarks that the most satisfactory explanation is that the so called timber line marks the extreme point of *minimum* temperature below which no exposed phenogamous plant can exist. All that survives above this point does so by submitting to a winter burial of snow, beneath which protecting cover it is enabled to maintain its torpid existence.

The great objection which this purely meteorological view presented to Mr. Meehan's mind was that the dwarfed and gnarled coniferæ extending so many hundred feet up the mountain sides, never produced seed, and we are reduced to the alternative of believing either that the seeds have been carried up the mountain sides in enormous quantities and to enormous distances from the fruitive trees below by winds, or else that there were seed-bearing progenitors of these scrubby pines, beneath the tall protecting branches of which they had their earliest stages of growth. He was satisfied from subsequent observations in the mountains of North Carolina, and in the White Mountains of New Hampshire, that this last view is the correct one,—that large timber trees at no very remote period extended much further up the mountain sides than they do now, and that they have since disappeared for reasons presently to be stated, leaving only the younger trees to struggle on as best they may.

Roan Mountain in North Carolina is about 6,300 feet above the level of the sea. Timber extends to its summit on some parts of it, while in other parts it is destitute of timber for many hundreds of feet down its sides. The species on the summit is *Abies Frazeri*, and *Abies nigra*. Oak and other trees come occasionally to near the top and at about 6,000 feet he measured a black oak—*Quercus tinctoria*,

that was five feet in circumference at three feet from the ground, and was perhaps forty feet high. The places destitute of trees were the steep declivities,—while those on which the trees were growing were of a more level character. Further down the mountain sides the steep inclines would be clothed with forest growth, as well as those of a more gradual ascent. It is of the summit only that the differences in inclination presented different forest aspects. But in the spaces clear of "Balsam" as the *Abies Frazeri* is popularly known, an occasional one of good size would be seen. In the close Balsam woods, both on the summit and lower down the mountain sides, crops of young plants would be found under the mature trees, but, what was very remarkable, there had evidently been no young trees started till the parents were near maturity. A large area with trees thirty or forty feet high would have an undergrowth of young ones a foot or so high, while other areas of younger trees, would have innumerable small seedlings growing among the damp moss beneath them, and it was further interesting to note that in most cases the crops of young plants in each area were about the same age in each case, as if the seeds in the several locations had all started to grow together in some one particular year, and probably at no other time. On the naked places, where few or no trees were now found, the surface would be closely covered by a matted growth of a grass almost peculiar to that region, *Danthonia compressa*, but a close examination of the surface showed occasional tracts of deep vegetable mold which had been formed by ages of decaying *Hypnum* or Sphagnum moss, and the evident remains of roots, just as we now find under the Balsam trees, and there is no doubt from these facts that these steep upper declivities were once clothed with trees and mosses, to which the grass previously named succeeded.

With these facts in mind he examined the arboreal features of the White Mountains in New Hampshire. On Mount Washington which is a little over 6,000 feet, the timber runs up to about 4,000 feet; while Mount Webster, a mountain forming the southern peak of the same chain, and about 4,000 feet high, has little timber above 3,000 feet. Clearly, climatic reasons will not account for these peculiarities. On Mount Washington there is much of the same character as distinguishes the forest of the Rocky Mountains. As already noted the timber line becomes marked at about 4,000 feet. For at least another thousand feet we meet with scrubby bushes of *Abies Balsamea*, *Abies nigra*, and *Abies alba*, with some *Betula papyracea*. Beyond this, and almost to the summit, an occasional specimen of one or another of the coniferæ may be seen. As noted in regard to the Colorado scrubby growth, none of these had ever produced seed; nor was it at all probable, from a careful survey of the locations, that many of the areas could have been seeded by the winds, however strong, bringing the seeds up these mountain heights. Moreover, there were many cases where there were intermediate areas clear of all scrubby spruce plants, and where seeds could be brought by winds in these modern times much easier than to the heights above. Besides this, it was evident that many of these dwarfed specimens were of immense age. Some that he examined were certainly fifty years old, though the

stems at the ground were no thicker than his wrist, and trailing on the ground, occupied but sixteen or twenty square feet of space. There seemed to be but little doubt that at some time in the past Mount Washington had forests of coniferæ at much higher elevations than at present, if not perhaps clean up to the summit; that these scrubby plants now there were seedlings that had sprung up under the elder ones, and that in time the older ones were destroyed, leaving the small ones beneath alone to their fate.

An examination of different parts of Mount Washington shows not only that this is the true explanation of the absence of good timber beyond what is known as the timber line, but that the same law is in progress to-day as in centuries past. Illustrations of this are numerous. There is now a railroad running straight up the mountain side from the base to the summit. Near the timber line, a cut had to be made through an area covered by mature Balsam Firs. This cut was about eight or ten feet deep. Under the trees, moss and dead roots and old fir leaves had made an earthy strata of a foot, or in places, more in depth. The moss was still green from the rains, melting snows, and fogs of this elevated region, and sustaining the various kinds of low vegetation common to these alpine heights. Young firs were springing up in great abundance. But all the larger trees were dead, though here and there might be seen a branch with a few lingering green leaves. This mass of dead, standing timber occupied several acres. The reason for their death was evident. The railroad cut showed that the forest stood on a mass of large but loose gneiss rocks, through which the waters from the two thousand feet of loose rock above rushed as soon as the railroad cut was made, carrying with it all the earthy matter on which the larger trees subsisted, but leaving the tough turfy matter at the surface, on which smaller trees of the same sort may live for many years, though the larger ones cannot longer exist. With the death of the larger trees there is, of course, an increase of light, and then the *Hierochlæ*, with other grasses and sedges, speedily take possession, holding together the loose soil, and even permitting in many cases an increase of the earthy layer, by holding much of the disintegrated rock which may be washed or blown on from above. Carefully examining patches of scrubby spruces above the timber line, it is not uncommon to find dark patches of vegetable mould evidently the remains of large trees that have been growing where now only the masses of small scrubby plants exist. In some places a sharp stick may be pushed down among the scrubby firs and spruces, and the earth found to be but a foot or so deep over the loose rock below, from which the earth has been wholly washed away. Again, there are some places, often nearly an acre in extent, where the scrubby firs are still standing, dead, from the earth having been washed away from below upward, not leaving enough for even the moderate demands of these little bushes.

In view of the facts detailed we may conclude that at the elevation of these mountain chains, the lowland vegetation was carried up at the same time. The summits, covered by luxuriant forests would present a cooler surface to the moist clouds, and there would be less condensation than on bare sun-warmed rocks,

and deep snows would be less frequent; and not sufficient to interfere much with arboreal growth. But the rain would of necessity carry down the earth and disintegrated rock to lower levels; and the melting snows, such as there were, would make this downward progress of the soil continuous. In some mountains where the rock was easily broken by frost, as in Colorado and the White Mountains, it would be very difficult for the soil to hold its own against these forces of gravitation; but on more solid rock the mass of tree roots protecting the rock, and retaining the earth matter, would longer hold its own. In the former case with the gradual washing away of the earth the larger trees will have to find a lower level; the summit condensing more moisture, and having a cooler atmosphere, would form heavier masses of longer enduring snow, and thus keep down from tall growth the younger trees left as the older and larger ones retired. They would have to be low bushes by the absence of earth for vigorous growth, and remain trailing bushes, through the superincumbent and long continued mass of snow.

We thus see that though a long continued mass of snow has much to do in marking a timber line, that line is precedent to the snowy mass. The primary cause is the gravitation of disintegrated rock—the movement of the hill-top toward the sea. From the moment the mountain reaches its highest point it commences its downward march. The entire reduction of the highest to a level with the plain is but a question of time The frost and rain and melting snow will do it all, and this reduction, bringing down not only the earth, but cold-loving plants to warmer levels, must continually change the aspects of vegetation, as well as perpetually vary the timber line.

In low hills as well as in high mountains the forces of gravitation are also at work. But the sides are seldom so steep as in the loftier hills,—the rains do not gather with such force nor are the melting snows of near the same duration. There are sudden washes, but not the continuous roll of the earth to the bottom. In time they may exhibit the same phenomena of the disappearance of species from their summits as their loftier brethren; but the centuries here will gather much more slowly to produce a similar effect.

In conclusion he would say briefly that the "timber line" of high mountain tops results from the washing down of the earth from the higher elevations.—*Proceedings of the Academy of Natural Sciences of Philadelphia.*

BOOK NOTICES.

NORSK, LAPP AND FINN. By Frank Vincent, 8vo pp. 263. G. P. Putnam's Sons, New York, 1881. For sale by M. H. Dickinson, $1.50.

Books of northern travel have been unusually numerous during the past year, and Putnams have had the good fortune to put forth some of the best of them.

The volume in hand is the work of an experienced traveler who has visited all parts of the world and some of whose books have been received with great favor. It is attractively written and the amount of information given as the direct observations of the author is large and well handled. No portion of it is heavy or dull; on the contrary the reader will almost certainly take a kind of personal interest in the adventures and investigations of the cheery writer, sympathizing with him in his hardships and enjoying keenly his successes in overcoming them. The work is illustrated with a frontispiece and a route-map, while the table of contents and index are exceptionally full and complete.

Commencing at Paris, the reader is taken, via Hamburg, Kiel and Korsor, to Copenhagen, or "Merchant's Haven," as the Danish word Kjobenhavn signifies when literally translated. To this city of commerce, religion, science, education and art are devoted ten pages, in which the reader is introduced to the the Library and Zoölogical Museum, the Literary and Educational Societies, the University, Thorwalsden's Museum, the Churches, etc.

A whole chapter is devoted to an enthusiastic description of the Museum of Northern Antiquities, the Ethnological Museum, the Chronological Collections of the Kings of Denmark, Relics of early Civilization, etc.

Progressing northwardly we are taken to Christiana, the picturesque fortress of Kronberg, the Kattegat and Skager Rak, introduced to the accomplished King of Norway, shown over the city and finally started on a long tour through Norway with its fields, fosses and fiords, its ancient Norse cities of Bergen and Trondjheim, its natural tunnels, Snow Mountains, its three grand Glacier systems.

We cross the Arctic circle, visit the once wonderful Maëlstrom, inspect the wholesale manufacture of cod-liver oil at Hammerfesh, canvass the wonderful fishing banks of Loffodens, study the character and customs of the people, spend a day at North Cape and witness the sun complete its full circle "by daylight."

The hard work of the author's journey began at this point, where he left the beaten track, crossed Norway eastwardly into Sweden and then journeyed southwardly to Stockholm, visiting the copper and iron mines, stopping over at Upsala where Odin, Thor and Frey are buried and where the oldest monument of the

Teutonic tongue is found, a copy of the four gospels in the old Gothic language written a thousand years before Gutenberg was born.

After Stockholm, Helsingfors, the Capital of Finland, on the other side of the Gulf of Bothnia, with its old castles and red houses, University and Botanical Garden; latterly made famous by the polar explorations of Nordenksjold, who was born in Finland and is now Professor in the University of Helsingfors.

The descriptions of the "Lapps and Finns" are extremely interesting, mainly because so little is known of them. The whole book is good and will abundantly repay reading.

THE FATHERS OF THE THIRD CENTURY. By Rev. George A. Jackson, 18mo. pp. 211; D. Appleton & Co., New York, 1881. For sale by M. H. Dickinson, 60 cents.

This is the second volume of the Early Christian Literature Primers, edited by Professor George P. Fisher, D.D., and published by Appleton & Co. The first included the Apostolic Fathers and the Apologists from A. D. 95 to 180.

Beginning with a chronological table of the Roman Emperors, Greek, Latin and Christian writers between A. D. 180 and 325, followed by an admirably comprehensive account of the progress of Christianity in the third century, the author takes up the Greek Christian writers, *seriatim*, beginning with the earnest Irenæus and continuing with the zealous and active Hippolytus, the philosophic Clement and closing with the lofty and learned student and orator, Origen, and gives briefly a summary of and extracts from the works of each. Of Latin writers, Tertullian and Cyprian are largely quoted and summaries of their principal works given.

To readers who cannot take the time necessary to study out the earlier history of Christianity, this series will be found exceedingly useful as showing the origin and formation of many of the doctrines of the Christian church. The volumes to follow, so far as announced, are the "Post Nicene Greek Fathers," and the "Post Nicene Latin Fathers."

FAIRWAY AND FOLLY. By James J. Reno; 8vo. pp. 585. Ramsey, Millett & Hudson, Kansas City Mo., 1881. For sale by the Kansas City Book & News Co., $2.50.

This is a well printed and handsomely bound temperance story. The plot is laid, and the materials for the tale found, in one of the interior towns of Missouri, where whisky had gained the ascendancy over the greater portion of the population.

There are many very good things said in the course of the story, and its general objects and aims are praiseworthy, but there is abundant evidence of a lack of experience on the part of the author as a writer. He has clearly aimed too high

in attempting, as his first effort, so large a work. As a writer of short sketches he doubtless would succeed better and probably acquire, in time and by practice, the degree of skill in the handling of his subjects and the versatility of style requisite to satisfy the popular taste in book-writing.

OTHER PUBLICATIONS RECEIVED.

Education in France, from the Bureau of Education, 144 pages octavo; *Ciel et Terre*, a popular Review of Meteorology and Astronomy, published at Brussels, Belgium, monthly; a Cartoon entitled "The Press in Danger," issued by the Anti-Monopoly League; Catalogue of Professors and Students of the State School of Mines of Colorado, Golden, Colo.; Joseph's Coat, by David Christie Murray, G. P. Putnams' Sons, N. Y. 50 cents; Sabbath Observance, Its Origin, History and Significance, by William Emmette Coleman, San Francisco, Cal.; Report on the Restoration of American Shipping in the Foreign Trade, San Francisco, November 15, 1881; Addresses of Hon. Geo. B. Loring, Commissioner of Agriculture, and Prof. C. V. Riley, U. S. Entomologist, at Cotton Convention, Atlanta, Ga., November 2, 1881; The Longitude of the Morrison Observatory, Glasgow, Mo., by Professors J. R. Eastman, U. S. N., and H. S. Pritchett, of Washington University.

SCIENTIFIC MISCELLANY.

WESTERN ARTISTS.

BY MRS. M. W. HUDSON.

"Western Artists!" the *æsthete* will exclaim, "Preposterous; there are no western artists. This country is too new. Artists keep near to centers of art and wealth." What, then, shall we call these dabblers in water-colors and oils who wear *sombreros* and oil-cloth coats, and carry camp-stools and sketch-books over the Rocky mountains the year round?

The sojourner in that vast region can hardly go amiss of one or more of these picturesque individuals on either a summer's or a winter's day. They swarm to this great open picture-book of nature in the warm seasons, and many remain to study the mid-winter "effects." Denver is full of studios, and hundreds of wealthy people from the eastern States, who visit the mountains, take home with them paintings for which they pay from twenty-five to five hundred dollars, each, or they give an order to a resident artist for a view which has especially pleased them, or they designate the kind of picture they desire; that is,

whether it shall be a near, or a distant mountain view, whether water, or rocks, or foliage shall predominate, whether it shall be romantic or beautiful—and have it sent after them when it is finished. This making of pictures to order is an extensive business in Colorado, and, if no better, these paintings are at least no worse than the shiny daubs of the "Palisades," "Lake George" and the "White Mountains," by "New York artists," with which cheap picture stores and street-peddlers have flooded the West for so many years, and it is the purpose of this rambling chat to defend, in a measure, the right of these western painters to the title of "artists;" a better right, at least, than the painters of most of the pictures which are brought to the West from the East by dealers.

Their strongest claim to the title lies in the fact that they are doing their best Comparatively few of the Rocky Mountain students are painting by the square yard for a living. Hundreds of them are inspired with the idea that they are "born" artists, that some day their works will be sought for and exhibited, and, best of all, paid for at a high price. Of course a majority of them will paint themselves out in a few years, but western people need not sneer at them as a class on that account, for there will be found among them comparatively as many real artists in ten years from now as there will be successful merchants among the many who are embarking in that pursuit, and it may result quite as much to the enviable fame of the great West if we, as western people, take a little pains to seek out and encourage the promising artists in our midst as to pay our court exclusively to the merchant princes. Of course we are a too practical people to think of comparing art to commerce in point of importance, but if we can recover for a moment from the intoxication of business we will all admit that we are in danger of crowding everything else out. And if we soberly reflect, we can conceive that Art was once young, even in Greece, and that it required the worship of a whole people to elevate it to the noble place it finally reached there.

It is worth while for any one who goes to the Rocky Mountains, and to Denver, to visit the *ateliers* and note the difference in the work of the numerous aspirants for fame. To be sure his feelings will be wounded when he sees the great canvases of some boy-painter who thinks he has caught the translucent atmosphere of a twilight or a day-break that is almost as subtle as the human expression, and that none but a Turner can mimic, and he will turn discouraged from the great bald rocks that look as if one might lay a hand on them and leave a deep imprint, as in putty, while the sky above them seems as hard as the bottom of a baking dish; but if he perseveres he will come upon a bit of cañon, or a burnt-pine mountain side with a new growth of quaking asps fringing its feet, or a snowy peak with a cool sky behind it, that will astonish him and please him greatly. He will say to himself, "After all there are some pictures here." And if he is at all picture-wise he will conclude that the best way to secure a satisfactory *souvenir* of the mountains is to seek it in the studios of Colorado Springs or Denver.

The bare idea of leaving an order for a painting is conclusive evidence to the artist that his customers know nothing of pictures, and he fills the order from a furnisher's stand-point, not from an artist's.

To persons who admire and intend to buy, but who do not pretend to critically judge of paintings, this hint will be valuable. A view of distant, snow-crowned mountains with sunset clouds behind them will never be satisfactory, and the longer one owns and studies such a picture the less satisfying it will become, that is, if it is prized as a mountain view. If it was bought for the clouds, it may be worth the money, though that is doubtful. The sunset hues of clouds and peaks in Colorado could not be outdone in vividness by any brush, it is true; neither could they have even justice done them by any brush in Colorado, hence they were better not attempted; but furthermore the warm colors of a sunset background bring the mountains so near that their immensity and majesty are necessarily lost. No perspective can overcome a red and yellow sky sufficiently to make a white peak drawn against it seem "miles and miles away." The only thing that can in a measure overcome the effect of these warm colors in a "distance" is the Moran haze. It would, perhaps, be more nearly correct to say the Turner-esque haze, for it is well known that Thomas Moran was a close student and a copyist of Turner's works, but as Moran is so well known in this country, though his two large paintings in the Capitol, at Washington, as the greatest artist who has ever attempted, Rocky Mountain scenery, and since his style has been clumsily aped by so many amateur landscape painters, is it not allowable to speak of the Moran haze? The writer has never seen his "Grand Cañon of the Yellowstone," nor the "Chasm of the Colorado," having never visited Washington City,—a confession which almost every American who has traveled at all should blush to make,—but all who have seen even one of his smaller pictures understand what is meant.

To the unpracticed eye this haze is very beautiful, but unless it is made by an artist it will soon be discovered that there is no picture behind it, that instead of looking through a visible atmosphere at an outspread landscape, one is really looking through a very gauzy veil hung before a hard wall.

After having looked at a great many pictures by western artists, the conclusion was very plain that if one wished to secure a picture of the mountains that would give the best idea of distance and height, he must select a clear, cool sky. If mists are attempted, let them be earthly, not heavenly. It should not be necessary to say that unless a purchaser knows when a picture is well drawn he runs a great risk of wasting his money, but no class of persons understand better than artists themselves, that thousands of pictures are bought every year in Colorado by persons who really know nothing about pictures, and that thousands of paintings are sold every year by "artists" who really know nothing of art.

But after one has gone the round of western artists' studios, examined their work, been pleased and disappointed by turns, with mountain, plain, glen, waterfall, sky and foliage, he will ask, "Where among them all is our coming American Landseer or Rosa Bonheur?" "Why have we not one among us who can

people his mountain fastnesses with the picturesque and graceful elk, deer and antelope?" If the American buffalo is not immortalized soon, whoever does it will have to take the "Last of the Mohicans" for his model.

The great opportunity open to a young American artist is to make an animal painter of himself, or herself, and although this little article is modestly addressed to amateur picture buyers, and not to artists in any sense, this suggestion is open to appropriation by any one worthy to take it up.

THE RISKS OF THE ELECTRIC LIGHT.

BY PROF. HENRY MORTON.

The sources of danger in the use of the electric light are essentially two; from the conducting wires and from the electric lamps. As long as the electric fluid or electric energy is conveyed by a sufficiently good conductor it is perfectly harmless, resembling a river flowing in its natural channel and powerless to rise above its banks; it is only when some easier channel into surrounding objects is offered, or some partial obstruction of a certain character impedes its regular flow, that trouble may arise. The conditions of these difficulties are, moreover, very peculiar. Thus, for example, if two electric conducting wires, forming the outgoing and returning paths of a powerful current, are placed near each other, but are separated by a bad conductor, as for example, when both are tacked onto a board partition wall, the current will follow the wire from end to end, with no development of heat in the same or tendency to leave the conductor or pass into any adjacent object. If, however, between the two conducting wires we introduce some imperfect conductor, such as a small wire, some metallic dust, or a film of water containing mineral matter in solution, then a portion of the current will be diverted into this "short cut" from wire to wire, and may heat the wire or metallic dust or the wood wet with the aqueous solution, so as to cause the ignition of inflammable matter. Accidents of this nature have already occurred. Thus a telegraph or telephone wire having fallen across one or more of the conductors used for street-lighting purposes has been fused, or, itself escaping, has caused the fusion of finer wires connected with it.

Again, two wires, being the outgoing and returning circuits of a powerful current, have been nailed side by side, without other insulation, on the same board of a floor, partition, or ceiling; and though used safely for a long time, while the wood-work was in its normal state, have developed a very dangerous activity when the wood between them was wet with dirty or impure water. In that case the water offers a circuit through which a cross current is established which first heats the damp wood, then chars it, and finally establishes a series of of minute arcs or electric sparks along the charred surface, which would soon develop a conflagration if left uncorrected.

Again, two such wires as above, insecurely attached near each other, may be brought into momentary contact and then separated, in which case an electric arc, with its intense light and heat, will be established between them. In like manner a conducting wire itself may be insecurely connected at some point, and if the abutting ends are separated slightly during use, a similar arc with its intense heat may be there developed.

Turning to the dangers which might be expected from the electric lamp, it is to be remarked, in the first place, that these in the case of the arc lights depend much upon the number of lamps operated on the same circuit. Thus, if thirty or forty lamps are operated in series, the electro-motive force of the current must be sufficient to maintain a corresponding number of arcs; and therefore if by any means many of these arcs are closed out, the electro-motive force of the current available for the remaining ones would be so excessive that their arcs might become excessively long, and even the metallic carbon-holders and other parts of the lamps constitute poles between which the arc would spring, melting the metal-work and establishing a very dangerous system of combustion.

To avoid this class of dangers, two provisions should be made. In the first place some arrangement in the lamp itself by which, whenever the arc exceeds certain safe limits, the current will be automatically diverted from it and carried through a good and sufficient conductor; and, in the second place, some apparatus in connection with the electric generating machine by which the electro-motive force of its current should be varied automatically in correspondence with the resistance of the circuit, so that any diminution of such resistance, as by the closing out of several arcs, should cause a corresponding diminution in the force of the current generated. Numerous contrivances for both of these purposes have been already carried to greater or less perfection and efficiency, and it is manifestly possible by such means to secure immunity from risks of this sort.—*Sanitary Engineer.*

EARTHQUAKES OF 1881.

Among the remarkable things for which 1881 will be long remembered are its earthquakes. Not since the memorable years 1811 and 1812 has there been such a wide circle of terrestrial disturbance as now exists. Seventy years ago nearly the whole western hemisphere trembled under the strain of internal commotion. But the area in which the earthquakes were felt was bounded by the two great oceans, and neither Europe or Asia suffered to any extent. The present area of commotion seems to have no limits. Reports of violent earthquakes have for many months past come from every quarter of the globe. The shocks that desolated Chios in April rank as agents of destruction with the earthquakes which destroyed Lisbon in 1755, Riobamba in 1797, and Caraccas in 1812. The recurrence of earthquakes within a few days at Chios which have again caused the inhabitants to flee for their lives, the shocks experienced at Agram

two or three weeks ago, and the recent shakings of the ground felt in New Hampshire and other places in the country, indicate that the disturbing forces are yet active in widely separated portions of the globe. In fact, the history of earthquakes show that when once a wide circle of commotion has been established, several years must pass before the internal forces exhaust themselves. The earthquakes that began in 1811 lasted until 1813. They were very frequent in the Mississippi and Ohio Valleys, and north of Cincinnati the shocks occurred for months at the rate of twenty or more a day. The farmers became so accustomed to them that they hardly stopped to lean on their hoes while an earthquake was shaking the corn-fields. This recalls Humboldt's account of his experience in South America in the beginning of the present century. He traversed regions in which earthquakes were so common that the inhabitants no more thought of taking account of their number than Europeans think of counting the showers of rain.

One of the most interesting things about earthquakes is their tendency to group themselves into periods. The present earthquake period began three or four years ago, and some supposed that it had reached its culmination last fall when Agram was overthrown. But the shocks increased in force until the terrible disaster at Casamicciola occurred in March last. This, in turn, was supposed to be the climax of a series of violent terrestrial commotions that, beginning in Peru in 1879, within a few months circled the earth. About a month later, however, came the great Chios earthquake, one of the most destructive on record; and this so far remains the crowning disaster of the present earthquake cycle. But the return of the shocks at Agram, and the indications of continued commotion in various parts of the earth show that another calamity of the same kind may happen any day.

Ordinarily, earthquakes are confined to countries in the neighborhood of volcanoes. But in periods of unusual activity, like the present, they sometimes occur in places where they are least expected. In the valleys of the Hudson, the St. Lawrence, the Ohio and Mississippi, shocks have been felt this year. Exactly what relation exists between volcanoes and earthquakes men of science are trying to find out. It seems to be settled that they both result from the same general cause. Whether the whole interior of the earth is a molten mass (a theory that has fallen out of favor of late), whether it contains reservoirs or pockets of molten rock under volcanic districts, or whether the phenomena of volcanoes or earthquakes are the result of some force not yet understood, makes little difference except so far as knowledge of the facts may enable science to master the laws that govern terrestrial disturbances. The significant fact, however it may be explained by theory or observation, is that the ball upon which we live, instead of being a dead, inert mass, a type of stability, is heaving under the strain of interior forces, which, though too insignificant, so far as human observation goes, to produce outbursts comparable to those in the sun or some of the larger planets, yet suffice at times to overthrow great cities, to burst mountains asunder, and to destroy at one stroke many thousands of human beings.

Scientific men have attacked this problem with admirable courage. Observatories have been erected on the banks of Vesuvius and Ætna, where the breathings of those monsters are carefully recorded, and skilled observers have been stationed in several of the earthquake centers of Europe and Asia, armed with ingenious instruments. If, as some prophesied, the present cycle of earthquakes is to last for several years, it is not impossible that we may be on the eve of discoveries that will enable us to foresee and prepare for the shakings that Mother Earth occasionally gives us.

Capt. Mallett, of the bark Cherokee, of Liverpool, which arrived here on Saturday, had an unusually interesting story to tell. Besides encountering severe gales in his voyage, he says he and his crew felt the effect of an earthquake at sea. At about six o'clock in the afternoon of August 6th, when they were nearly in the middle of the Atlantic, and about in the latitude of the northern part of Newfoundland, two severe shocks made the bark tremble from stem to stern. The shocks were between five and ten seconds apart. Capt. Mallett says that in his long experience as a seaman this is the first time he has ever felt an earthquake shock at sea, but he has been informed that such shocks have been felt by vessels in the South Atlantic near the Equator.

Dispatches from Chios say that the earthquake shocks in that island have been renewed within a few days, and that one village seems to be sinking. The inhabitants are deserting their houses in alarm.—*N. Y. Sun.*

GLASS AS A BUILDING MATERIAL.

Perhaps not one builder or contractor in ten, if told that the common grades of glass made at the glass factories in this city have a crushing strength nearly four times as great as that credited by experienced engineers to the strongest quality of granite, would accept the statement as true. Yet it is fact, and being so, the query as to why glass has not received more attention from architects as a structural material naturally suggests itself. A reporter had a talk with several prominent glass manufacturers on the subject, and in answer to an interrogatory as to whether blocks of glass could be made in suitable lengths and sizes and so annealed as to be utilized in the construction of a building in place of stone, they said that it could be done. Said one of these gentlemen: "This question has been considered by myself a number of times and, although I do not want to advocate the absolute abolition of brick and stone, yet in the erection of art galleries, memorial buildings, etc., a structure composed of blocks of glass in prismatic colors would be a unique, beautiful and lasting structure. With the numerous inventions which have come into use of late years in connection with the production of glass, the cost has been gradually going down, while the quality of the fabric is steadily becoming better. Now, as the Smoky City controls the bulk of the glass production, there could not be a more appropriate place for the erection of such a building.

One objection which would be raised to the durability of a glass house, in the literal sense of the words, might be that the blocks would not take a bind, or adhere together with common mortar. This objection can be readily set aside by the use of a good cement, and when completed the structure will stand for ages, barring extraordinary accidents or mayhap cataclysm. As to the cost of a glass house, it can be kept down to but a small percentage above the price of cut granite, as there are many points where saving gains can be made. Thus, for instance, in building with stone you have to pay the stone masons, and when it comes to elaborate examples of carving, in Corinthian pillars, collars and capitals, etc., why, the work is rather costly as compared with glass, when the latter can be molded into any shape or form, and the work accomplished in much less time. I am convinced that the time will come when we will see such a building erected. Scarcely a day passes but what the sphere of glass as an article of use becomes widened.

In parts of Germany, and on one line in England, glass ties are being used on railroads, and thus far have given satisfaction, combining all of the requisites of wooden ties with the virtue of being susceptible to usage at least seventy-five per cent longer than wood. Then by the Bastia process, glass articles are now being made for common use which can be thrown on the floor and will rebound like a rubber ball. Progress is also being made toward rendering glass, which has even been characterized as "the brittle fabric", ductile, and to-day threads of glass can be made that can be tied in knots and woven into cloth. Were one disposed to give play to fancy, and fuse it into fact, a house entirely composed of glass could be built with walls and roof and floors fashioned from melted sand. Carpets of glass could cover the floors, the wall decorations embodying the forms and colors of the most ultra æsthete, sitting on glass chairs or reclining on glass couches, arrayed in glass garments, eating and drinking from glass dishes, such an one could realize that the age of glass had come. Yet nearly all of this, fifty years ago, would have been classed with the then impossible telephone and electric light, and this statement would have likely found its place in the catalogue "expurgatorus."

Much has been said about the inability of modern glass manufacturers to make window glass imbued with the rich and beautiful colors peculiar to the windows of old cathedrals in England and on the Continent. It is not generally known, however, that the secret of securing those wondrous tints has been discovered by one of our glass manufacturers. After a long series of experiments conducted in conjunction with Mr. Thomas Garfield, of Boston, a cousin of the martyr President, he has found that the rich effects in those old cathedral windows are owing to the poorness of the quality of the glass. Owing to the imperfect mixing of the ingredients by the old glass-makers, the substance did not unite closely, and in consequence it became porous, and the minute particles of soda in the composition are exposed and act in the function of radiators, which give brilliancy to the colors of the window. In making window glass in colors,

now, the makers prefer to leave the surface rough, in order that by exposure to the elements it may go through the same beautifying process alluded to above.—*Pittsburgh Dispatch.*

THE GARDEN OF THE GODS, MANITOU, COLORADO.

BY WILLIAM ALLEN BUTLER.

Beneath the rocky peak that hides
In clouds its snow-flecked crest,
Within these crimson crags, abides
An Orient in the West.

These tints of flame, these myriad dyes,
This Eastern desert calm,
Should catch the gleam of Syrian skies,
Or shade of Egypt's palm.

As if to bar the dawn's first light
These ruby gates are hung;
As if from Sinai's frowning height
These riven tablets flung.

But not the Orient's drowsy gaze,
Young Empire's opening lids
Greet these strange shapes, of earlier days
Than Sphinx or Pyramids.

Here the New West its wealth unlocks,
And tears the veil aside
Which hid the mystic glades and rocks
The Red man deified.

This greensward, girt with tongues of flame,
With spectral pillars strewn,
Not strangely did the savage name
A haunt of gods unknown.

Hard by the gentle Manitou
His healing fountains poured;
Blood-red, against the cloudless blue,
These storm-tossed Titans soared.

Not carved by art or man's device,
Nor shaped by human hand,
These altars, meet for sacrifice,
This temple, vast and grand.

With torrents wild and tempest blast,
And fierce volcanic fires,
In secret molds, has Nature cast
Her monoliths and spires.

Their shadows linger where we tread,
Their beauty fills the place:
A broken shrine—its votaries fled—
A spurned and vanished race.

Untouched by Time the garden gleams,
Unplucked the wild flower shines,
And the scarred summit's rifted seams
Are bright with glistening pines.

And still the guileless heart that waits
At Nature's feet may find,
Within the rosy, sun-lit gates,
A hidden glory shrined;

His presence feel to whom, in fear,
Untaught, the savage prayed,
And, listening in the garden, hear
His voice, nor be afraid.

—*Harper's Magazine for December.*

BRAINS AND INTELLIGENCE COMPARED.

The brain is universally recognized as the organ of mind, and the size of this organ is very generally taken as an index of mental capacity. Big brains have come to be suggestive of great minds, while it is an undoubted fact that the possession of a brain which falls below a certain minimum standard of weight implies idiocy on the part of its unfortunate possessor. M. Broca places the lowest limit of brain-weight compatible with human intelligence at thirty-seven ounces in males and thirty-two in females, the average brain-weight in Europeans being about forty-nine ounces. Whether the possession of more than the average quantity of brain implies the presence of more than average intelligence is a question that has given rise to much discussion. It is an undoubted fact that very high brain-weights are occasionally found in people whose mental acquirements are certainly not above the average. Out of 157 brain-weights of adult Scotsmen, Dr. Peacock found that four, all belonging to artisans, who, so far as could be learned, had not been distinguished among their fellows by superior intellectual endowment, weighed over sixty ounces each, while the heaviest brain on record —it weighed sixty-seven ounces—belonged to a bricklayer. Dr. Morris, who

chronicled the case, was told that the man "had a good memory and was fond of politics, but that he could neither read nor write." Whatever his potentialities might have been, "it is evident," says Dr. Morris, "that his actual acquirements were not great." The non-development of superior mental power in such cases may, however, be attributable not to lack of capacity for learning, but to the absence of the conditions necessary to its growth. Certain it is, that among the educated and intelligent classes, the number of big brains is greater than with uneducated and less intelligent people. Among the latter the proportion of brain-weights above fifty-five ounces has been ascertained to be only from four to six per cent, while the proportion among men who have been distinguished for great intellectual acquirements, is at least twenty-three per cent.

The brain-weights of only twenty-three such men are accurately known, and it is from these that the above proportion has been obtained. With few exceptions, these were all above the average capacity of forty-nine ounces. First in this respect comes the celebrated naturalist Cuvier, with a brain-weight of sixty-four and a half ounces, followed by the famous Scottish physician, Abercromby, and the poet, Schiller, each with sixty-three. Goodsir, the anatomist, follows at a considerable distance with fifty-seven and a half, Sir James Simpson with fifty-four, and Chalmers with fifty-three. That such men as Gladstone, Bright, etc., possess more than the average brain-weight may be inferred from a statement lately made public of the size of hat worn by these and a number of other living or recently deceased statesmen and literateurs. Premising that what is known to the trade as size seven is that of the average head, with presumably forty-nine ounces of brain, and that seven and three-eighths is a size so large as only to be made when specially ordered, it appears that out of fourteen persons whose hat-sizes are given, two (Lord Chelmsford and Dean Stanley) were below, while others (Lord Beaconsfield and the Prince of Wales) were exactly up to the average. Of the others, Dickens, Selborne, and Bright required seven and one-eighth; Earl Russell, seven and one-fourth; Lord Macaulay, Gladstone and Thackeray, seven and one-eighth; Louis Philippe, seven and three-fourths, and the Archbishop of York, eight full. Of the twenty-three distinguished men already referred to whose actual brain-weights are known, four, including the late Prof. Hughes Bennet, and Hermann, the philologist, are distinctly below the average, showing, as Dr. Bastian points out in a recent work, that "a well-constituted brain of small dimensions may be capable of doing much better work than many a larger organ whose internal constitution is, from one cause or other defective." When there is no such defect, however, the big brain, there is every reason to believe, confers an undoubted advantage on its owners.—*Edinburgh Scotsman.*

THE MISSING LINK.

A reporter of the *Philadelphia Times* has been interviewing Professor E. D. Cope upon the descent of man from animals of the monkey tribe, and gives the following account of the statements of the Professor. Exhibiting a part of a diminutive skull not larger than the skull of a small ground squirrel, he said:

"It came from the valley of the Big Horn River, in Wyoming Territory, and is the upper part of the skull of a species of the marmoset monkey. It was found in the lowest eocene layer of the tertiary formation, and as for its age, I can hardly say. The years, however, run back so far that people who think this a new country would be considerably surprised if they knew the figures.

"This skull is remarkably similar, in miniature, of course, to the human skull. The brain space is remarkably large, and is, in fact, several times larger than the brain space of any of the skeletons of animals of the same period of time. The characteristics of the formation of the human skull are clearly defined, so clearly as to be remarkable. The teeth are almost the same as human teeth, while the jaw has many strong points of similarity. I consider this skull as the earliest indication of the existence of man. It is a new species of a familiar class, and has hitherto been unknown to scientists. The connection between man and this animal, it seems to me, must have been very close, although, of course, nine men out of every ten would raise a dispute. No animal at that time, except this peculiar species, had a head like that of a human being, and the brain space, contrasted with the brain space of other animals, or even of the monkeys of today, shows a vast superiority of intelligence.

EDITORIAL NOTES.

THE lecture of Dr. Edwin R. Heath before the Kansas City Academy of Sciences, in November, was well attended and gave great pleasure as well as instruction to his hearers. His own personal part in the discoveries made along the Beni River having been modestly suppressed, it was almost unanimously demanded by those present and will be given some time this winter. Dr. Heath has also consented to give three lectures before the Scientific Club, in Topeka, very soon. At the December meeting, held on the 27th ult., Professor J. M. Greenwood, of this city, read a paper in reply to the criticisms of Charles Francis Adams, George A. Walton, Richard Grant White and Bishop McQuaid on the public school system. It was an exhaustive review of the whole subject, showing careful study and ample reflection.

THE snow-plow invented by Mr. Osborne, of this city, bids fair to prove a success. In brief, the improvement consists in introducing a system of steam pipes between the mold-board and sheet-iron cover and keeping them hot from the engine boiler. When the plow enters the drift the snow is melted rapidly and such as does not melt is compacted together firmly at the sides of the track.

A PATENT has recently been taken out by gentlemen interested in this city for reducing to solid extract the *Polygonum Amphibium*, (Swamp Smart-weed,) for tanning purposes. This plant grows most abundantly in the swamps and low grounds of the West, and its tanning properties have long been known and utilized in a limited way, but it is not generally understood that it is far superior to oak or hemlock bark for the purpose. Professor Samuel Aughey, of the Nebraska State University, found 17.01 parts tannin in 100 of the dried tops, and 21.02 in 100 of the rhizomes or underground stems, while oak contains only from 6 to 10 per cent and hemlock still less. We examined some samples of calf-skin that had been immersed in a solution of this extract for only thirty days and which seemed to us perfectly tanned. The material is not only naturally abundant, but is easily cultivated, so that it need never become scarce nor dear, and there seems to be no reason why an immense and successful industry may not be put into operation right at home, to the advantage of all classes of citizens.

ON the 25th of November some defect in the machinery of the elevator at Meyer Brothers' store caused the car, which was loaded with sulphur in barrels to fall from the fourth to the basement floor. When the car struck the lower floor the barrels were bursted open by the concussion and the sulphur took fire. The question is, what ignited it? If, as is generally believed, it was the result of friction between the car and the iron check-ways, we must suppose that these irons were heated to redness, since sulphur does not ignite at a temperature below 560°, while iron shows dull red at 400°. It is more probable that the wooden frame-work of the car was ignited by the friction and communicated the flame to the sulphur.

PROFESSOR F. HAHN, of Leavenworth, Kansas, in proposing a new coal shaft at that place and basing his calculations upon the experience of Major Hopkins in sinking that at the State penitentiary, gives the sum of $30,282 as a very close approximation to the actual cost of reaching a workable vein of coal with citizen labor. The vein at the penitentiary was reached at 713 feet, and is twenty-one inches in thickness; estimated to yield by June, 1882, 6,000 bushels daily. At Rosedale, Kansas, the shaft sunk by Capt. Ira Harris is 326 feet deep and the vein is 21 inches thick. This shaft cost but about $15,000. With these successes before us there is no reason to doubt that similar results would follow mining for coal at this city; and with coal at ten cents a bushel, which Prof. Hahn estimates to be one hundred per cent profit to the owners of the mine, an impetus would be given to manufacturing that nothing else could give.

THE recent news from the Jeannette shows that Prof. Towne was not far out the way in his article in this number of the REVIEW upon the probabilities of her safety, when he predicted that Capt. DeLong might emerge from the Arctic basin by way of Spitzbergen in 1882. It appears that he had made nearly as much of the northwest passage as Nordinskjold did when his vessel was caught and crushed by the ice about three hundred miles northeast of the Lena River, in Siberia, and almost due east of Spitzbergen.

The total value of the product of the twenty-two field crops raised in Kansas, in 1881, is $91,910,439.27, or more than 30 per cent greater than in any previous year in the history of the State. The two that contribute the largest share of this immense total are wheat and corn; the former making $21,704,275.80, and the latter $44,859,963.29.

WE have received from the mayor and town clerk of Plymouth, England, a circular announcing the intention of the people of that city to erect a monument to the memory of Sir Francis Drake, who left that place on the 15th of November, 1577, on his ever memorable voyage around the globe. It is a worthy object, and all English speaking people should gladly avail themselves of the opportunity to contribute to it. Subscriptions may be sent to the treasurer or to Chas. F. Burnard, Mayor.

In the lower portion of the State of Delaware is a swamp from which for many years past cypress logs have been taken out by shingle-makers at a depth of some fifteen feet below the present surface, which is covered with a thrifty forest of a later day.

Dr. J. F. Snyder, of Virginia, Ill., in an article upon the Burial and Resurrection of the great Indian Chief, Black Hawk, in the St. Louis *Republican*, closes by saying: "The conviction is daily gaining strength that the race of Indians found in occupancy of this country when it was discovered by the Europeans were the people, or the immediate descendants of the people, who built the mounds, and students of American archæology now agree that mound-building was practiced by some of the tribes down to a comparatively recent date." We doubt whether Professor Putnam or any other first-class authority will endorse this statement without considerable qualification.

It is announced that a French engineer, M. Selibot, has discovered a method of using sulphuric acid in the reduction of ores of the precious metals, and, what is very essential to its practicability, a mode of recovering the acid after its evaporation. The process is to be tried in Denver in a practical form shortly.

In addition to coast line warnings the Signal Service Office has devised a system of railroad notifications, to be employed by lines traversing districts subject to "Northers," in warning other roads of the approach of such storms. Much good may be accomplished in this way, as road managers thus notified will have time to prepare for the snow-storms which at present so completely paralyze their operations. We presume that Gen'l Hazen's experiences on the great plains of the West have suggested this plan to him.

Professor F. J. Baker, of the M. E. College, Baldwin City, Kansas, sends his holiday greetings in the shape of a renewal of his subscription to "your most excellent and to me most interesting Review."

The city of Aurora, Ill., forty miles west of Chicago, is lighted by the electric tower plan. The system consists of six electrical towers, made of iron rods and net work, each one hundred and fifty feet high. They are crowned with electric lamps of two thousand-candle power each, or equal to one hundred and twenty-five gas jets. The cost complete for each tower and apparatus is about $1,000.

Mr. F. Siemens proposes to adapt toughened glass to the manufacture of street lamp-posts, water-mains, and other articles usually made of cast-iron. His claim for glass is that it is stronger than iron, it is imperishable and incorrodible. The profit to the maker will be twice that of cast-iron, but the specific gravity of glass is so much less than that of cast-iron that the consumer will be able to obtain articles at about thirty per cent cheaper than cast-iron.

The Committee on Instruction and Lectures, of the Academy of Natural Sciences of Philadelphia, announces that the course of instruction in Natural History, inaugurated last Spring, will be resumed during the coming Winter, commencing in the first week of January, 1882. The plan of instruction will be similar to that pursued in the first course, and will consist of Lectures and Practical Demonstrations in the Laboratory. Twenty-five to thirty lectures, upon "Physiography and Invertebrate Paleontology," will be delivered by Professor Angelo Heilprin. The course of instruction in Mineralogy will consist of about twenty-five lectures, to be delivered by Professor Henry Carvill Lewis. Admission to either of the courses may be obtained by application to the Recording Secretary, Dr. Edw. J. Nolan, Hall of the Academy, 19th and Race Sts. Terms, $8.00 for each course.

Dr. Edwin Ground, of Linton, Indiana, writes thus encouragingly of the Review: "It is arranged in a convenient, practical and concise manner, and is a journal, not for the professional scientist alone, but for the intelligent of every class; being adapted to the widest range of readers of any Science Journal with which I am acquainted."

chronicled the case, was told that the man "had a good memory and was fond of politics, but that he could neither read nor write." Whatever his potentialities might have been, "it is evident," says Dr. Morris, "that his actual acquirements were not great." The non-development of superior mental power in such cases may, however, be attributable not to lack of capacity for learning, but to the absence of the conditions necessary to its growth. Certain it is, that among the educated and intelligent classes, the number of big brains is greater than with uneducated and less intelligent people. Among the latter the proportion of brain-weights above fifty-five ounces has been ascertained to be only from four to six per cent, while the proportion among men who have been distinguished for great intellectual acquirements, is at least twenty-three per cent.

The brain-weights of only twenty-three such men are accurately known, and it is from these that the above proportion has been obtained. With few exceptions, these were all above the average capacity of forty-nine ounces. First in this respect comes the celebrated naturalist Cuvier, with a brain-weight of sixty-four and a half ounces, followed by the famous Scottish physician, Abercromby, and the poet, Schiller, each with sixty-three. Goodsir, the anatomist, follows at a considerable distance with fifty-seven and a half, Sir James Simpson with fifty-four, and Chalmers with fifty-three. That such men as Gladstone, Bright, etc., possess more than the average brain-weight may be inferred from a statement lately made public of the size of hat worn by these and a number of other living or recently deceased statesmen and literateurs. Premising that what is known to the trade as size seven is that of the average head, with presumably forty-nine ounces of brain, and that seven and three-eighths is a size so large as only to be made when specially ordered, it appears that out of fourteen persons whose hat-sizes are given, two (Lord Chelmsford and Dean Stanley) were below, while others (Lord Beaconsfield and the Prince of Wales) were exactly up to the average. Of the others, Dickens, Selborne, and Bright required seven and one-eighth; Earl Russell, seven and one-fourth; Lord Macaulay, Gladstone and Thackeray, seven and one-eighth; Louis Philippe, seven and three-fourths, and the Archbishop of York, eight full. Of the twenty-three distinguished men already referred to whose actual brain-weights are known, four, including the late Prof. Hughes Bennet, and Hermann, the philologist, are distinctly below the average, showing, as Dr. Bastian points out in a recent work, that "a well-constituted brain of small dimensions may be capable of doing much better work than many a larger organ whose internal constitution is, from one cause or other defective." When there is no such defect, however, the big brain, there is every reason to believe, confers an undoubted advantage on its owners.—*Edinburgh Scotsman.*

THE MISSING LINK.

A reporter of the *Philadelphia Times* has been interviewing Professor E. D. Cope upon the descent of man from animals of the monkey tribe, and gives the following account of the statements of the Professor. Exhibiting a part of a diminutive skull not larger than the skull of a small ground squirrel, he said:

"It came from the valley of the Big Horn River, in Wyoming Territory, and is the upper part of the skull of a species of the marmoset monkey. It was found in the lowest eocene layer of the tertiary formation, and as for its age, I can hardly say. The years, however, run back so far that people who think this a new country would be considerably surprised if they knew the figures.

"This skull is remarkably similar, in miniature, of course, to the human skull. The brain space is remarkably large, and is, in fact, several times larger than the brain space of any of the skeletons of animals of the same period of time. The characteristics of the formation of the human skull are clearly defined, so clearly as to be remarkable. The teeth are almost the same as human teeth, while the jaw has many strong points of similarity. I consider this skull as the earliest indication of the existence of man. It is a new species of a familiar class, and has hitherto been unknown to scientists. The connection between man and this animal, it seems to me, must have been very close, although, of course, nine men out of every ten would raise a dispute. No animal at that time, except this peculiar species, had a head like that of a human being, and the brain space, contrasted with the brain space of other animals, or even of the monkeys of today, shows a vast superiority of intelligence.

EDITORIAL NOTES.

THE lecture of Dr. Edwin R. Heath before the Kansas City Academy of Sciences, in November, was well attended and gave great pleasure as well as instruction to his hearers. His own personal part in the discoveries made along the Beni River having been modestly suppressed, it was almost unanimously demanded by those present and will be given some time this winter. Dr. Heath has also consented to give three lectures before the Scientific Club, in Topeka, very soon. At the December meeting, held on the 27th ult., Professor J. M. Greenwood, of this city, read a paper in reply to the criticisms of Charles Francis Adams, George A. Walton, Richard Grant White and Bishop McQuaid on the public school system. It was an exhaustive review of the whole subject, showing careful study and ample reflection.

THE snow-plow invented by Mr. Osborne, of this city, bids fair to prove a success. In brief, the improvement consists in introducing a system of steam pipes between the moldboard and sheet-iron cover and keeping them hot from the engine boiler. When the plow enters the drift the snow is melted rapidly and such as does not melt is compacted together firmly at the sides of the track.

A PATENT has recently been taken out by gentlemen interested in this city for reducing to solid extract the *Polygonum Amphibium*, (Swamp Smart-weed,) for tanning purposes. This plant grows most abundantly in the swamps and low grounds of the West, and its tanning properties have long been known and utilized in a limited way, but it is not generally understood that it is far superior to oak or hemlock bark for the purpose. Professor Samuel Aughey, of the Nebraska State University, found 17.01 parts tannin in 100 of the dried tops, and 21.02 in 100 of the rhizomes or underground stems, while oak contains only from 6 to 10 per cent and hemlock still less. We examined some samples of calf-skin that had been immersed in a solution of this extract for only thirty days and which seemed to us perfectly tanned. The material is not only naturally abundant, but is easily cultivated, so that it need never become scarce nor dear, and there seems to be no reason why an immense and successful industry may not be put into operation right at home, to the advantage of all classes of citizens.

ON the 25th of November some defect in the machinery of the elevator at Meyer Brothers' store caused the car, which was loaded with sulphur in barrels to fall from the fourth to the basement floor. When the car struck the lower floor the barrels were bursted open by the concussion and the sulphur took fire. The question is, what ignited it? If, as is generally believed, it was the result of friction between the car and the iron check-ways, we must suppose that these irons were heated to redness, since sulphur does not ignite at a temperature below 560°, while iron shows dull red at 400°. It is more probable that the wooden frame-work of the car was ignited by the friction and communicated the flame to the sulphur.

PROFESSOR F. HAHN, of Leavenworth, Kansas, in proposing a new coal shaft at that place and basing his calculations upon the experience of Major Hopkins in sinking that at the State penitentiary, gives the sum of $30,282 as a very close approximation to the actual cost of reaching a workable vein of coal with citizen labor. The vein at the penitentiary was reached at 713 feet, and is twenty-one inches in thickness; estimated to yield by June, 1882, 6,000 bushels daily. At Rosedale, Kansas, the shaft sunk by Capt. Ira Harris is 326 feet deep and the vein is 21 inches thick. This shaft cost but about $15,000. With these successes before us there is no reason to doubt that similar results would follow mining for coal at this city; and with coal at ten cents a bushel, which Prof. Hahn estimates to be one hundred per cent profit to the owners of the mine, an impetus would be given to manufacturing that nothing else could give.

THE recent news from the Jeannette shows that Prof. Towne was not far out the way in his article in this number of the REVIEW upon the probabilities of her safety, when he predicted that Capt. DeLong might emerge from the Arctic basin by way of Spitzbergen in 1882. It appears that he had made nearly as much of the northwest passage as Nordinskjold did when his vessel was caught and crushed by the ice about three hundred miles northeast of the Lena River, in Siberia, and almost due east of Spitzbergen.

The total value of the product of the twenty-two field crops raised in Kansas, in 1881, is $91,910,439.27, or more than 30 per cent greater than in any previous year in the history of the State. The two that contribute the largest share of this immense total are wheat and corn; the former making $21,704,275.80, and the latter $44,859,963.29.

WE have received from the mayor and town clerk of Plymouth, England, a circular announcing the intention of the people of that city to erect a monument to the memory of Sir Francis Drake, who left that place on the 15th of November, 1577, on his ever memorable voyage around the globe. It is a worthy object, and all English speaking people should gladly avail themselves of the opportunity to contribute to it. Subscriptions may be sent to the treasurer or to Chas. F. Burnard, Mayor.

In the lower portion of the State of Delaware is a swamp from which for many years past cypress logs have been taken out by shingle-makers at a depth of some fifteen feet below the present surface, which is covered with a thrifty forest of a later day.

Dr. J. F. Snyder, of Virginia, Ill., in an article upon the Burial and Resurrection of the great Indian Chief, Black Hawk, in the St. Louis *Republican*, closes by saying: "The conviction is daily gaining strength that the race of Indians found in occupancy of this country when it was discovered by the Europeans were the people, or the immediate descendants of the people, who built the mounds, and students of American archæology now agree that mound-building was practiced by some of the tribes down to a comparatively recent date." We doubt whether Professor Putnam or any other first-class authority will endorse this statement without considerable qualification.

It is announced that a French engineer, M. Selibot, has discovered a method of using sulphuric acid in the reduction of ores of the precious metals, and, what is very essential to its practicability, a mode of recovering the acid after its evaporation. The process is to be tried in Denver in a practical form shortly.

In addition to coast line warnings the Signal Service Office has devised a system of railroad notifications, to be employed by lines traversing districts subject to "Northers," in warning other roads of the approach of such storms. Much good may be accomplished in this way, as road managers thus notified will have time to prepare for the snow-storms which at present so completely paralyze their operations. We presume that Gen'l Hazen's experiences on the great plains of the West have suggested this plan to him.

Professor F. J. Baker, of the M. E. College, Baldwin City, Kansas, sends his holiday greetings in the shape of a renewal of his subscription to "your most excellent and to me most interesting Review."

The city of Aurora, Ill., forty miles west of Chicago, is lighted by the electric tower plan. The system consists of six electrical towers, made of iron rods and net work, each one hundred and fifty feet high. They are crowned with electric lamps of two thousand-candle power each, or equal to one hundred and twenty-five gas jets. The cost complete for each tower and apparatus is about $1,000.

Mr. F. Siemens proposes to adapt toughened glass to the manufacture of street lamp-posts, water-mains, and other articles usually made of cast-iron. His claim for glass is that it is stronger than iron, it is imperishable and incorrodible. The profit to the maker will be twice that of cast-iron, but the specific gravity of glass is so much less than that of cast-iron that the consumer will be able to obtain articles at about thirty per cent cheaper than cast-iron.

The Committee on Instruction and Lectures, of the Academy of Natural Sciences of Philadelphia, announces that the course of instruction in Natural History, inaugurated last Spring, will be resumed during the coming Winter, commencing in the first week of January, 1882. The plan of instruction will be similar to that pursued in the first course, and will consist of Lectures and Practical Demonstrations in the Laboratory. Twenty-five to thirty lectures, upon "Physiography and Invertebrate Paleontology," will be delivered by Professor Angelo Heilprin. The course of instruction in Mineralogy will consist of about twenty-five lectures, to be delivered by Professor Henry Carvill Lewis. Admission to either of the courses may be obtained by application to the Recording Secretary, Dr. Edw. J. Nolan, Hall of the Academy, 19th and Race Sts. Terms, $8.00 for each course.

Dr. Edwin Ground, of Linton, Indiana, writes thus encouragingly of the Review: "It is arranged in a convenient, practical and concise manner, and is a journal, not for the professional scientist alone, but for the intelligent of every class; being adapted to the widest range of readers of any Science Journal with which I am acquainted."

MR. ALEXANDER AGASSIZ is credited with the very truthful remark that "the pupil studies Nature in the school room, and when he goes out of doors he cannot find her."

ITEMS FROM PERIODICALS.

THE Beloit (Wis.) *Outlook* says of the REVIEW: "This interesting Western monthly is well advanced in its fifth year and is becoming better and better."

MR. W. E. HIDDEN has recently announced, through the *American Journal of Science*, the discovery by him of emeralds of good quality and in considerable quantity, about sixteen miles northwest of Statesville, in Alexander County, North Carolina.

A NEW college magazine, entitled *The Missouri University Review*, will be started in February, 1882. It will be edited by Dr. S. S. Laws, President, with Professors McAnally, Thomas and Blackwell, as associate editors. The first volume will consist of five numbers, issued in February, April, June, October and December, devoted chiefly to educational matters in Missouri. The names and well-known ability of the editors are a sufficient guarantee of the high standing this magazine will occupy in the educational field. Subscription price, $1.00 per annum. Address, *Missouri University Review*, Columbia, Missouri.

THE "Concepts and Theories of Modern Physics," by J. B. Stallo, will be soon published by Appleton & Co., as a volume of the popular *International Scientific Series*.

FOWLER & WELLS, publishers of the *Phrenological Journal*, are just sending out a profusely illustrated volume entitled "Phrenological Miscellanies," comprising some 450 pages, made up largely from articles which have appeared in the *Journal*.

THE *Literary World*, E. H. Hames & Co., Boston, is a fortnightly review of the best new books and, from the care and just discrimination with which its articles are written, should be in the hands of every librarian and book buyer in the country. Large quarto, 32 pages; $2 00 per annum.

PROFESSOR R. A. PROCTOR'S new scientific magazine, *Knowledge*, is said to have secured a very large circulation already in Great Britain, and on the continent. It has not yet traveled as far west as Kansas City, where the Professor has so many admirers.

MAJOR LAUER, of the Austrian engineers, has for some time been using a new method for blasting rocks under water at Krems on the Danube. The chief feature of his system is the employment of a hollow cylinder, like a gas-pipe, to place the dynamite cartridge on the surface of the rock which it is desired to shatter. The dynamite is exploded by means of electricity, and the effect is said to be greater than that of the usual cartridge in a hole bored in the rock, and a saving of forty per cent is effected over the old system.

C. LLOYD MORGAN, F. G. S., in an article on "Miniature Physical Geology," in the December number of the London *Journal of Science*, calls attention to the process of fossilization which may be seen in progress in the blown sand on Mount's Bay. This blown sand, composed of sand and shell fragments, in process of time covers up such scrubby vegetation as lies in its path. This vegetation rapidly decays and is as rapidly replaced by lime, taken up from an aqueous solution of the shell fragments, until a complete cast or pseudo-morph is formed which in many cases preserves the exact form, even to the most minute filaments, of the decaying root or branch.